SECOND ANNUAL REPORT

OF THE

STATE

AGRICULTURAL EXPERIMENT STATION,

AT

AMHERST, MASS.

1884.

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MASSACHUSETTS STATE

AGRICULTURAL EXPERIMENT STATION.

AT AMHERST, MASS.

BOARD OF CONTROL, 1884.

OFFICERS APPOINTED BY THE BOARD OF CONTROL.

C. A. GOESSMANN, Prof. of Chemistry at the Mass. Agricultural College.
Director and Chemist.

S. T. MAYNARD, Prof. of Botany at the Mass. Agricultural College.
Supt. of Horticultural Experiments, Microscopist and Draughtsman.

ASSISTANTS.

JOSEPH B. LINDSEY, Class '83,* . *Stock-feeding and Chemical Analysis.*
CHAS. H. PRESTON, Class '83,* . *General and Analytical Chemistry.*
H. J. WHEELER, Class '83, . . *General and Analytical Chemistry.*
WINTHROP E. STONE, Class '82, . *Biology and Field Experiments.*
DAVID WENTZELL, . . . *Farmer.*

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* Messrs. Preston and Lindsey have since accepted more lucrative positions elsewhere.

BOSTON, MASS., Jan. 31, 1885.

To the Massachusetts State Board of Agriculture.

GENTLEMEN: — I beg to enclose the annual reports of the Director and Treasurer of the experimental station at Amherst, for the year ending 1884.

Respectfully submitted.

O. B. HADWEN,
Secretary.

SECOND ANNUAL REPORT

OF THE

DIRECTOR OF THE STATE AGRICULTURAL EXPERIMENT STATION AT AMHERST, MASS.

To the Honorable Board of Control.

GENTLEMEN: — The work carried on at the experiment station during the past year, has been, as far as practicable, in conformity with the plans presented for your consideration at the first quarterly meeting of the Board.

The farm-house, originally designed for office and working rooms, has been changed into a dwelling-house for the farmer of the station, retaining one room for keeping the farm records. The grounds around the farm buildings have been rendered attractive by improvements in the roads and otherwise.

An experienced practical farmer, for several years previous tried in the service of the college, has been engaged since the first of April, 1884, to carry out, as directed, the practical work in the field and barn of the station.

Part of the stables for keeping animals for feeding experiments, have been fitted up, at an early date of the season, to meet the temporary requirements in that direction. Three feeding experiments — two with milch cows and one with pigs — are described within this report. Others are in progress, and will be reported, as soon as finished, in our periodical bulletins.

The work in the field has been in several directions, and to the full extent of the present resources. The underdrained plats described in the previous report, have been again planted with corn without manuring, to prepare them for special trials with various manurial substances, in connec-

tion with a careful examination of the drainage waters passing out.

Arrangements have been made to study the effect of commercial fertilizers, — compounded at the station, — on the quantity and the quality of the crops grown by their aid, as compared, in both directions, with the growth of the same plants upon unfertilized lands of a corresponding soil. Four standard grasses, two millets and one reputed variety of corn, are included in that trial. The mode of operation and the first year's results form part of the enclosed report.

Some field observations have been instituted to study the specific action of different forms of potassa — muriate and sulphate — on the character of the crops raised under their influence. Besides various kinds of small fruits, fruit trees, etc., a prominent crop, the potato, has been selected for that purpose.

Six reputed forage crops, vetch, serradilla, white lupine, horse bean, common lucerne, and sand lucerne, belonging to the valuable family of farm plants of which the clover is a conspicuous representative — *Leguminosæ* — have been planted with a view to study their adaptability to our climate, and eventually to increase our chances for raising a greater variety of nutritious fodder for farm live stock.

Many of these experiments will require years of close observation before reliable deductions can be safely drawn from the results obtained from them, — features more or less common to all field experiments, — a good argument in favor of an early beginning of the work.

The products of the garden and the orchard have received their share of attention. The work undertaken in these important branches of agricultural industry proposes to ascertain the quality, and the relative and absolute quantity, of mineral constituents of prominent fruits and garden crops. A more reliable information in that direction will secure for us a careful basis for special fertilization, and thereby a more rational mode of their cultivation. The results presented in this connection have been greatly increased by a series of valuable contributions of Prof. S. T. Maynard: observations in regard to insects injurious to the apple; notes upon insects injurious to farm and garden crops; on the causes of

certain diseases of grasses; observations regarding the vitality of the seeds of various weeds; vitality of seeds as affected by age, and the destruction of peach buds by cold. His personal report forms the first chapter of this report.

The various crops raised in connection with the previously enumerated field experiments have, in most instances, been subjected to a chemical analysis, for the purpose of obtaining additional information for a judicious decision regarding their true character.

Experiments are under way with ensilaging fodder corn and pearl millet. A description of the results will be published as soon as the silo shall be opened for examination.

The work in the chemical labratory has been in various directions, and quite extensive, considering circumstances. Aside from the numerous analytical examinations in connection with the experiments in stock-feeding and in the field, a considerable number of fodder plants have been chemically tested for general information.

A large number of agricultural chemicals and other commercial manurial matter, not included in the control of the laws for the sale of licensed fertilizers, besides refuse material from various manufacturing industries throughout the State, have been analyzed at the request of farmer's clubs and farmers, in most instances at the special solicitation of the officers of the societies.

Many analyses of milk have been made, for the purpose of studying the influence of various kinds of feed on its quality.

Considerable attention has been given to the testing of drinking waters sent on from various localities in the State. The importance of attending more systematically, on farms, to the supply of a good water for drinking, has been discussed in a subsequent communication.

The calls upon the station for testing material of various descriptions, and interesting to farmers, have been quite frequently beyond its temporary resources, and had to be deferred at times, contrary to the best interest of the applicants.

Arrangements have been perfected of late to keep a complete weather record, and to assist the United States Signal

Service in the dissemination of useful knowledge. A set of ordinary meteorological instruments, uniform with those in use at Washington, have been placed in a suitably constructed and advantageously located little wooden structure, in the vicinity of the farm-house. As the record kept during past years upon the grounds has been incomplete, for want of suitable instruments, we have availed ourselves of the kindness of Miss S. C. Snell of Amherst, and insert a copy of her last year's weather record. In addition to this particular favor she has kindly consented to a copying of the entire elaborated weather record of her distinguished father, the late Prof. E. S. Snell of Amherst, Mass., which extended over nearly fifty years, and is one of the most valuable weather records within the United States. The copy of this record will be made with particular reference to the months of April and May and August and September, to meet the special interests of the farmers.

A consideration of the above enumeration of the work undertaken at the station during the past year, may show that it has been the aim to meet, as far as practicable, the purpose for which this institution has been established. The various directions in which experimental inquiries, thus far, have been inaugurated, it will be conceded, are of first importance, and open an extensive field for investigation. Some experiments promise valuable results at an early date, and others necessitate years of systematic observation; none of them can be neglected for any length of time without serious consquences to our farm industry. The work thus far outlined represents at best but a limited selection of subjects, regarding which better information is essential for a successful advancement of the best interest of our farmers.

To carry on any investigation in the field, the barn and the laboratory requires time, skill and pecuniary means. Experience teaches that first expenses for inaugurating a series of experiments are quite frequently comparatively small, and the necessity for skilful assistants less imperative, than when the work becomes more intricate in its advance, and calls for exceptional accommodations, more complicated and expensive apparatus, and a more liberal supply of skilled assistance.

The State experiment station furnishes no exception in this direction. For over two years the work has been carried on within the means furnished by the State, without incurring serious responsibility from a financial standpoint. The most rigid economy only has enabled the managers to meet, to some extent, the emergency of the case. This, even, has not been possible without serious detriment to the successful working of the station, and thus, ultimately, the best interests of the farming community. The requirements for carrying out the present system of management has of late reached a point where more means are indispensable in the interest of success. A short description of present conditions cannot fail to support my previous statement. The stalls for feeding are in some instances in an unfinished condition, and in the majority of cases only finished to serve temporary purposes. There are no means to secure animals most desirable for experiment, beyond a choice from the limited stock of the college.

The fields rented from the college are only properly treated as far as the experimental plats are concerned; the remaining larger portion of the area, consisting of exhausted grass land, had to be left in that undesirable condition, for want of means to render it more productive. Arrangements for producing steam, for carrying on experiments with the products of the dairy, and for keeping ice, are wanting. The same is the case with reference to suitable rooms for experiments to study the specific action of various forms of plant food under well defined conditions, for hot-beds and sheds. Many of the farm tools have still to be borrowed of the college, nor has the station thus far been able to compensate the college for the use of house, barn and fields.

The chemical work called for has long outgrown the resources of the present laboratory. Efficient chemical investigation needs better and more extensive rooms, and a larger and more selected supply of apparatus. Above all, more privacy is desirable for important chemical and other scientific work, than a part of a much frequented college building, constructed for a different purpose, can furnish. A new building, designed with a view to meet the present and still

growing special wants of the station in the above-mentioned direction, will prove ultimately the best economy.

The scientific assistance has thus far been supplied, in a great measure, by recent graduates of the college, at rates insufficient to retain their services beyond a limited period of time; a circumstance detrimental to the successful accomplishment of scientific work of a more intricate character. To give a somewhat more reasonable compensation for their services would serve a twofold desirable purpose; *i. e.*, secure good work and prepare some graduates of our college for teachers in the higher branches of scientific and industrial education. It needs no additional arguments to show that the kind, the character and the extent of the services which this new institution shall render to the State, stand in a direct relation to the character and the special scientific skill of those charged with the work.

The best use which can be made of the results of a well-conducted experiment or analysis obtained in a public institution like the State Agricultural Experiment Station, consists in placing them at once in the hands of those interested in its work. To meet this end monthly bulletins, containing short statements of the work accomplished, have been sent out. The special calls for these publications increased rapidly from three hundred to two thousand. Want of means necessitated the discontinuance of these bulletins since November. There is at present no prospect of issuing new bulletins for several months hence, on account of the low state of finances. The work in barn and laboratories continues from day to day, and the results are allowed to accumulate without serving their principal purpose.

The activity of the station has not infrequently, for this reason, been exposed to an undeserved unfavorable criticism. More facts of a similar character might be presented, if needed, to justify the request to ask for better working rooms, better apparatus and a more liberal appropriation of money, to meet the united call of the working farmers of the State.

Other States, with less agricultural interests at stake, have appropriated of late more than twice the sum for their exper-

iment stations than we receive at present, with a larger field of investigation assigned by our State laws.

In concluding my report, it gives me pleasure to express my sincere thanks for the kind consideration I have enjoyed from you during the past year, in the management of my charge.

I am, very respectfully,

C. A. GOESSMANN,
Director of the State Experiment Station

COMMUNICATION FROM PROF. S. T. MAYNARD.

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1. Observations in Regard to Insects Injurious to the Apple.

In the growth of all kinds of farm or garden crops, the farmer and gardener find themselves forced to wage constant warfare with insects or parasitic plant life. In this paper we give the results of a few observations in regard to the plum weevil or curculio (*Conotrachelus nenuphar*), as affecting the apple crop, compared also with the codling moth and the apple maggot.

It has often been noticed, early in the summer, that apples nearly all fall from the trees when quite small. This was especially the case during the past season, and a careful investigation was made to ascertain the cause. A tree of the variety known as the Westfield Seek-no-further, which blossomed very abundantly and set an unusually large crop of fruit, was selected. When from one-half to one inch in diameter, the fruit began to drop in large numbers, so that not enough was left on the tree for one-half a crop. A large quantity of these were collected and examined, and out of eight hundred it was found that all but three were punctured by the plum curculio, leaving its peculiar crescent-shaped mark, and in every puncture was found an egg or small larva. The worms commonly found in the apple at this time have generally been supposed to be the larvæ of the codling moth (*Carpocapsa pomonella*), yet in the number examined only four or five of the larvæ of the latter were found.

The remedies which have been successfully employed to prevent the injury of the plum crop by these larvæ are two; *i. e.*, (1) that of jarring the trees and catching the insects and affected fruit in a sheet stretched on a frame or spread

on the ground, and destroying them; and (2) that of planting the trees in limits of poultry yards. The first remedy cannot be applied to the apple tree on account of its size. The second has proved successful in saving the plum crop, and would undoubtedly be as successful with the apple; but the fowls should be numerous enough to not only catch the insects when they come from the ground, but also to let none of the larvæ escape when they come from the fallen fruit to go into the ground. Perhaps a more sure preventive would be, in addition to the above, to have the fruit destroyed by pasturing swine in the orchard in sufficient numbers to eat all of the fruit as soon as it drops.

The apple crop is also very much injured by the larvæ of the codling moth, mentioned above, which has been common for a long time, and the apple maggot (*Tripeta pomonella*), which has only done serious damage within the past five years. The latter injures the fruit by making burrows in the flesh, many larvæ or maggots often working in the same apple. The eggs are laid by a small fly, — somewhat resembling the common house-fly, but not more than one-half its size, — through a small opening in the skin of the apple made with its ovipositor. It shows especial liking for the thin-skinned, mild, sub-acid or sweet summer or autumn varieties, but also attacks some winter varieties. Its ravages have become so extensive in some localities that prompt measures must be taken for its extermination, or it may work the total destruction of the apple crop.

The practice of pasturing swine in the summer is being recommended and practised by many of our leading farmers and stock-breeders, and the orchardist must combine to a certain extent this branch of business with his own if he would be successful, for the destruction of the fruit as it falls from the tree is the only *safe* and *sure* remedy now known to prevent injury by these three insects.

2. Notes upon Insects Injurious to Farm and Garden Crops.

In the First Annual Report of the station is to be found a statement of experiments made to ascertain the best means of destroying the many insects that make havoc among the crops of the farm and garden. Some of the experiments gave satisfactory results, and extended preparations are being made to learn more of the *more harmless materials* that may be used as insecticides. As the results cannot be presented to the public in time to be of use the early part of this season, we give a brief statement of the remedies thus far found to be the most successful.

Cabbage Flea.—The first insect of importance that appears is the small black flea or jumping beetle that attacks the cabbage, radish, turnip, etc. Dusting with paris green mixed with one hundred times its weight of plaster has proved an effectual remedy. This must be done when the plants are wet, and after every rain.

Cut-worm.—The cut-worm, of which there are several species, including the army worm, works only during the night, and may be destroyed by the same remedy as the above. We would advise a trial of pyrethrum powder mixed with five times its bulk of plaster as being more safe, although we have no positive proof that it will be effectual.

Striped Squash-Bug.—The striped squash-bug, which has been so abundant for the past two seasons, is best kept in check by the use of plaster and paris green. For the family garden the safest and most satisfactory way to overcome them is to make a bottomless box twelve inches square and six or eight inches deep, and cover it with mosquito netting. One of these boxes placed over each hill until the plants have become tough and hard, is a sure protection.

The Potato Beetle.—The potato beetle has evidently become a permanent resident among us. Paris green extended with plaster, flour or water, is the only cheap and easily applied remedy known at present; but great care must be exercised in its use, and especially in the place where the package is kept, that it may not get upon the food of animals.

Cabbage Worm. — The cabbage worm, the larva of the common white butterfly, may be easily destroyed in several ways. That of hand-picking, if begun before the first brood has passed into its perfect state, is effectual. We have also found that pyrethrum powder mixed with five times its bulk of plaster, and dusted into the centre of the leaves with sulphur bellows, is certain destruction to every one of them. The application of insecticides in liquids to the cabbage has not been satisfactory, on account of the peculiar structure of the leaf surface, which allows the water to roll off in drops, and not adhere to any part of it. Paris green is unsafe to use after the leaves have become over four inches in diameter.

Currant Worm — The currant worm should be destroyed while small, with the dust of hellebore or pyrethrum. The latter being perfectly harmless is to be more highly recommended.

Plum Weevil. — There are two certain methods of capturing the plum weevil; the first by jarring the tree early in the morning and catching them upon sheets stretched below upon a frame or upon the ground, and the second by placing chicken coops under the trees. The former method must be attended to regularly every morning for three weeks after the plums have set; and in the latter case, if the number of trees is large, a large flock of chickens will be required to make that remedy effectual.

Codling Moth. — No positive remedy against the ravages of this insect has as yet been found. It is claimed that paris green sprayed over the tree in water is effectual; but should it prove so, it is far too dangerous a remedy to apply where grass or other crops are growing under them.

Apple and Peach Borer. — For the destruction of these two insects no sure remedy has been found, except the knife. It is probable that covering the trunk of the tree near the ground with the ink or tar used to catch the moths of the canker worm, or wrapping around the trunk bands of tarred paper, would assist in keeping them away.

The Rose Bug. — The rose bug has thus far been the most difficult to overcome of the whole tribe of injurious insects, and we can recommend no remedy with a great degree of confidence, but would advise the trial of the fumes of gas tar

held under the vines a short time every evening while the grapes are forming. It is certainly offensive to them, and if used carefully need not injure the plant.

Rose Slugs. — This insect is easily destroyed by spraying with water and pyrethrum, at a rate of one tablespoonful of the latter to a pailful of the former.

Letters. — Several letters have been received asking for information in regard to insects and fungus injurious to plants, which have been answered by letter, and for general information we insert the answers of a few of them.

Letter No. 1, containing shoots of the apple tree covered with a coating of black masses containing some fungus growth. These black masses are the result of dust adhering to the shoots made sticky by the exudations of the common apple aphis or plant louse, which were unusually abundant the past two seasons and caused great injury to young trees. The remedy is to syringe with strong soapsuds, or with a tablespoonful of pyrethrum in a pail of water.

Letter No. 2, containing twigs of the peach tree in which were found a double row of the eggs of the tree cricket (*Oecanthus niveus*). This insect lays its eggs more commonly in the branches of the raspberry and blackberry, but in some cases in those of the peach and plum. The larvæ, after hatching, leave the twigs and for a time feed upon plant lice, and later in the season upon succulent ripe fruits. The tree cricket is light green in color, and when full grown is about three-fourths of an inch long, and lays its eggs in autumn in the centre of the shoots in long lines, as mentioned above.

3. On the Causes of Certain Diseases of Grasses.

June Grass and White Top. — To this grass, on account of the many inflorescences that fail to mature and turn white, is often given the name of *white top*, and the question is often asked, "What is the cause of this condition?" Upon careful investigation it has been found that this condition is most prevalent upon land exhausted by long cropping, or where the roots have been much injured by the larvæ of the June bug or May beetle. The turning of the top to a white color is due to the destruction of the culm or stalk, just above

the last leaf, by a fungus growth. Upon rich land, and where there are few insect larvæ working at the roots, there is little or none of this white top, and we are led to reason that the fungus does not attack the stem of the grass until the cells have become weakened in some way.

4. Observations Regarding the Vitality of the Seed of Various Weeds.

The several subjects submitted to me for answers by the Board of Control have been carefully investigated, and I am able to make the following report: —

1. How is the vitality of the seeds of our most common weeds, such as dock, sorrel, chickweed, shepherd's purse, white daisy, etc., affected by the action of the digestive organs of animals?

Answer. Seeds of the dock, sorrel, daisy and shepherd's purse were fed to a horse and the refuse collected. Upon careful examination it was found that the seeds, unless crushed, were uninjured, and germinated readily when placed in soil, under proper conditions of heat and moisture. The experiment was repeated several times with the same result.

2. How is the vitality of the common weed seeds, like the above, affected by the action of the compost heap?

Answer. Having settled the point that weed seeds are not destroyed by the action of the digestive organs of animals, it becomes important to know how their vitality may be destroyed; for while the thorough farmer should never allow weeds to mature their seeds on his farm, there are many instances where it becomes necessary to provide some means by which chance seeds may be destroyed. A series of experiments were carried out, the result of which is, that seeds are destroyed if exposed to a temperature of from 90° to 110° F. for from five to seven days in a moist compost heap. In a dry compost heap, where the temperature runs as high as the above, the seeds were found but little injured. The tests were applied only to the above-named seeds; but it is probable that the results would be the same upon others, as these are among the seeds of the greatest vitality. The efficiency of this mode of destruction depends upon the maintenance of a continued high temperature and moisture,

which will cause the seeds to either germinate and then decay, or to decay before germinating. The amount of moisture can be easily regulated, and by properly working over any pile of compost containing a large amount of organic matter, the required amount of heat may be obtained. From the above experiments it would seem doubtful if the practice of keeping swine upon manure piles, to cause slow decomposition, is the best for manure containing weed seeds. It is also doubtful if the seeds of weeds, often put into the pens where pigs are kept, will be destroyed by the action of the little heat there generated. It would probably be safer, in both of the above cases, to compost the manure in large piles before using it upon the land.

3. At what stage of blooming are the seeds of the white daisy (*Leucanthemum vulgare*) matured enough to germinate?

Answer. This weed has become so abundant in the grass land of some sections of the State that it must be cut with the grass, and it becomes important to know if it can be cut with the grass before the seeds mature. After a series of careful examinations it has been decided that when the flower first reaches its full expansion few or no seeds are mature enough to germinate, but that it requires only a few days for these seeds to mature to full ripeness.

In view of these facts it would not seem safe for the farmer to depend wholly upon the early stage of cutting, but to afterwards compost all manures made from fodder containing weed seeds of any kind.

5. Vitality of Seeds as Affected by Age.

The question of the vitality of seeds as affected by age, is one of great importance to every cultivator of the soil, and while our experiments are far from being complete, as far as the number of varieties are concerned, yet we give the results, hoping at some future time to extend the tests to other varieties of seeds and perhaps to those of greater age.

The temperature, moisture and other conditions, during these tests, were made very nearly that required for the best growth of each kind, and *duplicate* tests were made, in all cases, to insure accuracy.

For each test ten seeds were taken, and the results are given below: —

Collection No. 1.

(Put up by Wm. Lyman, Leverett, Mass., in 1868.)

		No. of Seeds Germinating.	No. Days before First Seed Started.
1	Pop-corn,	–	20
2	Yellow Field Pumpkin,	–	20
3	Tomato,	–	20
4	White Spine Cucumber,	–	20
5	Boston Marrow Squash,	–	20
6	Stowell's Evergreen Corn,	–	20
7	Pepper,	1	2
8	Mountain-Sweet Watermelon,	–	20
9	Ox-heart Cabbage,	–	20
10	Giant White Celery,	–	20
11	Large Red Wethersfield Onion,	–	20
12	Sage,	–	20
13	Early Horn Carrot,	–	20
14	White Flat Turnip,	1	14
15	Drumhead Lettuce,	–	20
16	Early Scarlet Radish,	–	20
17	Early Turnip Beet,	5	16
18	Large Dutch Parsnip,	–	20
19	Dan O'Rouke Pea,	–	20

Collection No. 2.

(Collected by Student, from 1868 to 1872.)

1	Com'n Golden Rod (Solidago Nemoralis),	–	20
2	Com'n Golden Rod (Solidago Lanceolata),	–	20
3	Com'n Golden Rod (Solidago Canadense),	–	20
4	Com'n Plantain (Plantago Major),	–	20
5	Apple,	–	20
6	Quince,	–	20
7	White Birch,	–	20
8	Citron Melon,	–	20
9	Musk Melon,	3	12
10	Cucumber,	–	20
11	Hubbard Squash,	6	10
12	Broom Corn,	–	20
13	Thoroughwort,	–	20
14	Common Milkweed,	–	20
15	Fire-weed,	–	20
16	Beggar's Tick,	–	20
17	Butter-weed,	–	20
18	Stag-horn Sumac,	–	20
19	Evening Primrose,	–	20
20	Cone Flower,	–	20
21	Tobacco, Connecticut Seed-leaf,	–	20
22	Sweet Brier,	–	20
23	Pigweed,	–	20
24	Curled Dock,	–	20
25	Smartweed,	–	20
26	Sunflower,	–	20
27	Rhubarb,	–	20

Collection No. 3.

(Collected by Students in 1878.)

		No. of Seeds Germinating.	No. Days before First Seed Started.
1	White Tazelbe Wheat,	–	20
2	Arnouth Spring Wheat,	–	20
3	Black Swedish Oat,	–	20
4	Somerset Oat,	–	20
5	Schonen White Oat,	–	20
6	Excelsior Oat,	–	20
7	Probstier Barley,	–	20
8	Saxonian Barley,	–	20
9	Red Clover,	10	4
10	Yellow Clover,	10	4
11	Alfalfa Clover,	10	4
12	Alsike Clover,	2	6
13	Bokhara Clover,	5	4
14	White Clover,	6	4
15	Lucerne,	10	4
16	Winter Rape,	10	3
17	Summer Rape,	10	3
18	Desmodium,	–	20
19	Teasels,	–	20
20	Fengreek,	10	3
21	Vetch,	5	10
22	Lentile,	–	20
23	Blue Lupine,	3	6
24	White Lupine,	10	6
25	Carter's Imperial Pea,	–	20
26	Nohoot Pea,	–	20

Collection No. 4.

(Seed taken from a German Collection made in 1878.)

1	Trifolium Pratense,	5	7
2	Trifolium Hybridum,	4	7
3	Festuca Ovina (Sheep Fescue),	2	12
4	Festuca Pratensis (Meadow Fescue),	9	12
5	Festuca Duriuscula (Hard Fescue),	–	–
6	Lolium Perenne (Perennial Rye-grass),	3	12
7	Lolium Italicum (Annual Rye-grass),	8	12
8	Poa Pratensis (June-grass),	–	20
9	Poa Nemoralis (Wood Meadow-grass),	–	20
10	Dactylis Glomerata (Orchard-grass),	–	20
11	Agrostis Vulgaris (Red Top),	–	20
12	Agrostis Stotonifera (Creeping Bent-grass),	10	16
13	Authoxanthum Oderatum,	5	14
14	Alopecurus Pratensis (Meadow Foxtail),	–	20
15	Phleum Pratense (Timothy Hay),	8	12
16	Aira Flexuosa (Hair-grass),	–	20
17	Medicago Sativa (Lucerne),	10	5

COLLECTION NO. 5.

(Seeds put up by J. M. Thorburn & Co., 1883.)

		No. of Seeds Germinating.	No. Days before First Seed Started.
1	Festuca Ovina (Sheep's Fescue), . .	–	20
2	Festuca Elatior (Meadow Fescue), . .	5	9
3	Festuca Rubra (Red Fescue), . . .	10	9
4	Festuca Duriuscula (Hard Fescue-grass), .	2	9
5	Poa Pratensis (June-grass), . . .	4	10
6	Agrostis Vulgaris (Red-Top grass), . .	–	–
7	Agrostis Stotonifera (Creeping Bent-grass),	–	–
8	Bronus Mollis (Soft Chess-grass), . .	4	9
9	Lolium Perenne (Perennial Rye-grass), .	10	9
10	Lolium Italicum (Annual Rye-grass), .	6	9
11	Alopecurus Pratensis (Meadow Foxtail), .	–	–
12	Aira Flexuosa (Hair-grass), . . .	–	
13	Avena Elatior (Oat-grass), . . .	4	9
14	Avena Flavescens (Yellow Oat-grass), .	5	10
15	Dactylis Glomerata (Orchard-grass), .	7	9
16	Authoxanthum Oderatum (Sweet Vernal-grass, ...	8	10
17	Phleum Pratense (Timothy-grass), . .	9	9
18	Panicum Germanicum (Hungarian Millet),	8	9
19	Phalaris Arundinancea (Blue Joint-grass),	6	9
20	Holcus Lanatus (Soft Grass), . . .	6	9
21	Cynosurus Cristatus (Crested Dogtail), .	10	10
22	Reana Luxurieus, ...	–	–
23	Bermuda Grass, ...	–	–
24	White Clover, ...	10	2
25	Red Clover, ...	10	2
26	Crimson Clover, ...	10	2
27	Alsike Clover, ...	10	2
28	Alfalfa Clover, ...	10	2
29	Yellow Clover, ...	10	2
30	Bokhara Clover, ...	10	2
31	White Lupine, ...	10	7
32	Blue Lupine, ...	5	6
33	Yellow Lupine, ...	6	6
34	Vetch, ...	10	6
35	Horse Bean, ...	10	7
36	Spurry, ...	4	6

It will be seen that those varieties which, as a rule, are most hardy and productive, and consequently most generally planted, have generally retained their vitality the longest.

6. The Destruction of Peach Buds by Cold.

In New England one of the greatest obstacles met with in the cultivation of the peach is the destruction of the fruit buds by cold.

Many theories have been advanced to account for this injury, and in order to obtain definite knowledge of the condition of the buds during the season when the injury takes place, examinations were made at intervals of from three to five days from November 15th to the time of their destruction. At the beginning of the examinations, the buds were all found to be in a fully matured condition and the bud scales very closely united, making the bud firm and compact. This condition continued until after the warm days of the last of November.

December 6th the buds scales were found to have loosened and the stamens and pistils to have increased very much in size. December 16th some buds were found to have been destroyed altogether. The temperature at this time had only reached 18° above zero. Most of the buds, however, only indicated an advanced stage of growth; in a few instances, the rudimental petals began to take on some color.

Upon examination after the severe cold of December 19th and 20th, every bud examined, whether growing upon high or low land, or with a northern or southern exposure, was found to be destroyed.

The facts brought out by the above examination, were as follows: that the buds were started into growth by the warm days of the last of November and the first of December; that in this condition some of them were destroyed at a temperature of 18° above zero; and that all were destroyed when the temperature reached 10° below zero.

What would have been the effect of this amount of cold upon buds in a less advanced state of growth, cannot be determined until we have a season less favorable for their development.

ON FEEDING EXPERIMENTS.

C. A. GOESSMANN.

Careful investigations in stock-feeding have taught us lessons similar to those we have learned to appreciate in feeding plants, or in the cultivation and the production of farm crops. All our farm plants need nitrogen, phosphoric and sulphuric acids, potassa, soda, lime, magnesia and iron; yet not two species of plants have been found, which need the same quantity of these substances, during their entire period of life, nor at any stage of their growth. No one of the above-stated essential mineral constituents of plants can replace another one to any extent without altering the character of the plant, or even endangering its life. Potassa cannot take the place of lime, nor phosphoric acid that of sulphuric acid. When lime is needed, a shovelful of that substance is worth more than any quantity of the many times more expensive potassa. That particular mineral element which supplies an actual want of the soil is, for this reason, from a physiological standpoint, considered the most important one for the production of the plant; for without it the remaining essential mineral constituents of plants, whatever their quantity may be, cannot make them grow.

In regard to the growth and the support of our farm live stock, similar relations have been noticed. Actual feeding experiments have shown that three groups of plant constituents (nitrogenous, non-nitrogenous, and mineral constituents) are required to sustain successfully animal life. No one or two of them, alone, can support it for any length of time. In case the food does not contain digestible non-nitrogenous substances, the fat and a part of the muscles of the animal on trial will be consumed in the support of respi-

ration before its life terminates. In case nitrogenous constituents are excluded, the formation of new blood and flesh from the food consumed ceases, for the animal system is not capable of producing their principal constituents from anything else than the nitrogenous constituents of the plants.

Herbivorous animals receive these substances directly from the plants; carnivorous animals indirectly, by feeding on herbivorous animals. We feed, at present, our farm stock too frequently without a due consideration of the general natural law of nutrition; to deal out our fodder crops only with mere reference to name, instead of making ourselves more familiar with their composition and their particular quality, deprives us even of the chance of drawing an intelligent conclusion from our present system of feeding.

To compound the animal diet with reference to the *particular organization* of the *animal*, its *age* and its *functions*, is of no more importance than to select the fodder substances with reference to *its special wants*, as far as the *absolute* and *relative quantity* of the *three essential groups* of food constituents are concerned.

The peculiar character of our home-raised fodder articles is apt to conceal their special deficiency for the various purposes they are used for in a general farm management. They all contain the three essential food constituents, yet in widely varying proportions, and they ought, therefore, to be supplemented in different directions, to secure their full economical value. To resort to more or less of the same fodder article to meet the special wants, may meet the case as far as an *efficient* support of the animal is concerned, yet it can only in exceptional cases be considered good economy.

To satisfy the craving of the stomach and to feed a nutritious food are both requirements of a healthy animal diet, which, each in their own way, may be complied with. The commercial fodder substances, as oil-cakes, meal refuse, brans and our steadily increasing supply of refuse material from breweries, starch works, glucose factories, etc., are admirably fitted to supplement our farm resources for stock-feeding; they can serve in regard to animal growth, and support, in a similar way as the commercial fertilizer in the growth of farm crops, by supplementing our home resources.

To feed an excess of fodder materials, as roots and potatoes, which contain a large proportion of non-nitrogenous substances, as starch, sugar, digestible cellular substance, etc., means direct waste; for they are ejected by the animal, and do not materially benefit the manure heap. In case of an excessive consumption of nitrogenous constituents, a part of the expense is saved in an increased value of the manure, yet scarcely enough to recommend that practice beyond mere exceptional cases. The aim, therefore, of an economical stock-feeding must be to compound our various fodder materials in such a manner that the largest quantity of each of the three groups of fodder substances which the animal is capable to assimilate, should be contained in its daily diet to meet the purpose for which it is kept.

To compound the fodder rations of our farm stock with reference to the special wants of each class of them, is an essential requirement for a satisfactory performance of their functions; to supply these wants in an economical way controls the financial success of the industry.

The problem is an intricate one; years of careful experimenting were required to accumulate observations sufficient in number and in quality, to impart to the conclusion arrived at the claim of being worthy of a serious consideration. The first attempt to lay down rules for compounding the fodder rations of all kinds of farm stock on rational scientific principles, was made by Dr. Grouven, director of the Agricultural Experiment Station at Salzmünden, Germany, 1858–1864. He began his work with a critical compilation of feeding experiments made by competent parties, some ninety in number, his own extensive experiments included. He ascertained in each case the amount of each fodder substance consumed per day during each experiment; and calculated subsequently, from their analyses, the character and the amount of the daily fodder rations.

By this operation he learned the exact amount of nitrogenous, non-nitrogenous and mineral substances digested per day, under definite circumstances, by each class of farm animals. The amount of fat which had been fed in the fodder substances was separately recorded, on account of its exceptionally high feeding value, as a heat-producing material.

The results of his calculations were repeatedly tried by actual feeding experiments, to test the correctness of his conclusions. The main object of Grouven's work consisted in bringing the results of more than twenty years' careful investigations within the reach oi the practical farmer. In presenting his fodder standards to them, he recognized the natural imperfections of a first effort, More than twenty years additional experience in leading European agricultural experiment stations has modified some details in Grouven's statement; yet the great value of his method to compound rational, and thus more economical fodder rations for farm animals, has received an unqualified endorsement.

For more details regarding the subject here under discussion I refer to some previous publications contained in the reports of the Secretary of the Massachusetts State Board of Agriculture; see 1879–80, pages 221 to 237; 1882–83, pages 89 to 127.

The station proposes to benefit by the lessons of the past as far as the application of the method of compounding fodder rations for various kinds of live stock is concerned; yet leaves the working out of a rational and economical diet to the teachings derived from home experiments. The results of a few feeding experiments carried on at the station are reported with such details as will enable the student of a rational system of stock-feeding, as well as the farmer, to obtain the desired information. Whenever our results have accumulated in sufficient degree to entitle to a generalization, a more detailed discourse will follow.

I. — Notes on Feeding Experiments with Corn Ensilage.

The experiments were chiefly carried on for the purpose of testing the feeding value of corn ensilage, as compared with that of hay. A description of the general character of the ensilage, as well as of the hay and corn meal used in this connection, will be found upon a few subsequent pages within this report.

Three cows — crosses between native stock and Ayrshires — of a corresponding milking period — were selected from the herd of the Massachusetts Agricultural College, to serve

for the trial. The previous mode of feeding, the amount of each article of fodder actually consumed per day, and the daily yield of milk, were carefully noted during the week preceding the removal of the animals to the stalls of the station (April 7–14). Each cow had received for some time previous to that date, four quarts of clear corn meal per day, together with all the hay they could consume.

This mode of feeding was continued at the station, from April 14 to 29, by careful application of the scale in all measurements to secure reliable values for comparison.

History of Cows.

I. Name, FAIRY; age, 5 years; weight, 862 pounds; number of calves, 2; last calf, Feb. 20, 1884; feed, 4 quarts of clear corn meal (6½ pounds) and 17 pounds of hay per day. Average yield of milk per day, 18½ pounds (April 14 to 30).

COMPOSITION OF MILK.	April 8.	April 11.	April 14.
Water at 100° C.,	87.46	87.67	87.54
Total solids,	12.54	12.33	12.46
Fat (in solids),	3.33	3.20	3.34

Mean of Three Analyses.

Water,	87.56
Total solids,	12.44
Fat (in solids),	3.29

II. Name, NELLIE MAY; age, 4 years; weight, 860 pounds; number of calves, 2; last calf, Feb. 15, 1884; feed, 4 quarts of clear corn meal (6½ pounds) and 16½ pounds of hay per day. Average yield of milk per day, 14½ pounds.

COMPOSITION OF MILK.	April 8.	April 11.	April 14.
Water at 100° C.,	87.57	87.18	87.09
Total solids,	12.43	12.82	12.91
Fat (in solids),	3.71	3.82	3.87

Mean of Three Analyses.

Water,	87.28
Total solids	12.72
Fat (in solids),	3.80

III. Name, CLARA; age, 5 years; weight, 895 pounds; number of calves, 3; last calf, Feb. 25, 1884; feed, 4 quarts of clear corn meal (6½ pounds) and 15½ pounds of hay per day. Average yield of milk per day (April 14 to 30) 15½ pounds.

COMPOSITION OF MILK.	April 8.	April 11.	April 14.
Water at 100° C.,	88.04	87.32	87 39
Total solids,	11.96	12.68	12.61
Fat (in solids),	3.27	3.48	3.56

Mean of Three Analyses.

Water,	87.58
Total solids,	12.42
Fat (in solids),	3.44

Statement of Dry Vegetable Matter Consumed in form of Hay and Corn Meal by each Cow before Ensilage was introduced.

I.—FAIRY.

		Dry Matter.	Cost.
Hay consumed per day,	17.00 lbs.	15.30 lbs	12.75 cts.
Meal consumed per day,	6.50 lbs.	5.60 lbs.	9.10 cts.
	23.50 lbs.	20.90 lbs.	21.85 cts.

Daily produce of milk,	9¼ quarts.
Cost of fodder per day,	21.85 cents.
Cost of milk per quart,	2.36 cents.

II.—NELLIE MAY.

		Dry Matter.	Cost.
Hay consumed per day,	16.33 lbs.	14.70 lbs.	12.25 cts.
Meal consumed per day,	6.50 lbs.	5.60 lbs.	9.10 cts.
	22.88 lbs.	20.30 lbs.	21.35 cts.

Daily produce of milk,	7¼ quarts.
Cost of fodder per day,	21.35 cents.
Cost of milk per quart,	2.93 cents.

III.—CLARA.

		Dry Matter.	Cost.
Hay consumed per day, . . .	15.46 lbs.	13.90 lbs.	11.60 cts.
Meal consumed per day, . . .	6.50 lbs.	5.60 lbs	9.10 cts.
	21.96 lbs.	19.50 lbs.	20 70 cts.

Daily produce of milk, ...	7.6 quarts.
Cost of fodder per day, ...	20.7 cents.
Cost of milk per quart, ...	2.7 cents.

After the previously stated mode of feeding, and the quantity and quality of the milk obtained thereby, had been carefully tested during two weeks' observation under the management of the station,

Corn Ensilage

was introduced as an additional article of the daily diet, in the following way: The amount of corn meal, four quarts ($6\frac{1}{2}$ pounds) per day, remained the same during the entire trial. The ensilage was gradually substituted for the hay in the daily fodder, as the animal felt disposed to consume it. During the first twelve days of the experiment, each was offered forty pounds of ensilage per day, and subsequently sixty pounds, besides all the hay they would consume. They varied widely in their preference, as subsequent detailed statements show. The manner of feeding was as follows: At 5.30 A. M. the meal and shorts were fed to the animals during milking, and at 6 o'clock the ensilage; at 12 o'clock, M., from four to five pounds of hay were offered, and at 5 P. M. the remainder of the meal was given, and the rest of the ensilage soon after. At 8 o'clock, P. M. from four to five pounds of hay were again offered. Any material remaining after each feeding was removed and weighed. As a rule, they consumed first the leaves of the corn, and left,

if any, more or less of the harder stem parts behind. They received twice per day all the water they would drink.

I. — Name, FAIRY.

[A.] *Record of Month of May.*

1884. FEEDING PERIOD.	Food Consumed (lbs.) per Day. Indian Meal.	English Hay.	Ensilage.	Milk Produced (lbs.) per Day. Morning.	Evening.	Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).
Periods.						
May 1–6,	6½	8	40	10	9	18.
6–12,	6½	8	40	10⅓	9	18.
12–18,	6½	7⅓	59	10	9	19.9
18–31,	6½	7⅓	54½	10	9	19.4

Analyses of Milk.

Water,	87.16	86.99	86.84	87.33	87.55	87.57
Solids,	12.84	13.01	13.16	12.67	12.45	12.43
Fat (in solids),	4.08	3.88	3.93	3.60	3.29	3.37

Mean of Three Last Stated Analyses of Milk.

Water,	87.41
Solids,	12.59
Fat (in solids),	3.43

The cows, with the exception of No. III., retained their original weight well.

[B.] *Record of Month of June.*

	Food Consumed (lbs.) per Day.				Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal.
	Corn Meal.	Wheat Shorts.	Hay.	Ensilage.	Morning.	Evening.	Total.		
June 1, . .	6½	–	8	55	9½	8	17½	20.0	–
2, . .	"	–	8	60	9½	8	17½	20.6	–
3, . .	"	–	8	60	10	9	19	20.6	885
4, . .	"	–	8	60	10	9½	19½	20.6	–
5, . .	"	–	7	60	10	9½	19½	19.7	–
6, . .	"	–	8	60	10½	9½	20	20.6	–
7, . .	"	–	8	60	10	9½	19½	20.6	–
8, . .	"	–	7	58	11½	9	20½	19.5	–
9, . .	"	6½	7	60	11	9½	18½	25.4	–
10, . .	"	"	7	60	11	9	20	25.4	–
11, . .	"	"	7	60	11	9	20	25.4	–
12, . .	"	"	6	60	11	10	21	24.5	–
13, . .	"	"	6	60	11	10	21	24.5	–
14, . .	"	"	7	55	11	10	21	24.8	–
15, . .	"	"	8	60	11	10	21	26.3	–
16, . .	"	"	8	57	11	10	21	25.9	–
17, . .	"	"	16	Discontinued; stock of ensilage exhausted.	11	10	21	25.7	910
18, . .	"	"	15		10½	10	20½	24.8	–
19, . .	"	"	15		11	10	21	24.8	–
20, . .	"	"	14		10½	10	20½	23.9	–
21, . .	"	"	14		10	10	20	23.9	–
22, . .	"	"	14		10½	10	20½	23.9	–
23, . .	"	"	15		10	9½	19½	24.8	–
24, . .	"	Discontinued.	*16		10½	9	19½	20.0	885
25, . .	"		*20		10½	10	20½	23.6	–
26, . .	"		*20		10½	9½	20	23.6	–
27, . .	"		*20		10	9½	19½	23 6	–
28, . .	"		*20		10	10	20	23.6	–
29, . .	"		*20		10	10	20	23.6	–
30, . .	"		*20		10	10	20	23.6	–

* New hay.

Analyses of Milk.

	June 10.	June 16.	June 30.
Water, ...	87.10	86.60	87.36
Solids, ...	12.90	13.40	12.64
Fat (in solids), ...	3.61	3 83	3.53

II. — Name, NELLIE MAY.

[A.] *Record of Month of May.*

1884. FEEDING PERIOD.	Food Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.		Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).
	Indian Meal.	English Hay.	Ensilage.	Morning.	Evening.	
Periods.						
May 1-6, ...	$6\frac{1}{2}$	$7\frac{1}{2}$	40	$8\frac{1}{2}$	$7\frac{1}{2}$	17.6
6-12, ...	$6\frac{1}{2}$	$7\frac{1}{3}$	40	$8\frac{1}{3}$	7	17.4
12-18, ...	$6\frac{1}{2}$	6	54	8	$7\frac{1}{3}$	18.1
18-31, ...	$6\frac{1}{2}$	$5\frac{2}{3}$	$45\frac{1}{2}$	8	$7\frac{1}{3}$	16.7

Analyses of Milk.

	May 3.	May 7.	May 12.	May 20.	May 23.	May 26.
Water, ...	87.00	87.09	87.43	87.39	87.19	87.37
Solids, ...	13.00	12.91	12.57	12.61	12.81	12.63
Fat (in solids), ...	3.81	3.91	3.86	3.80	3.68	3.68

Mean of three last stated Analyses of Milk.

Water, ... 87.32
Solids, ... 12.68
Fat (in solids), ... 3.72

[B.] *Record of Month of June.*

	Food Consumed (lbs.) per Day.				Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal.
	Corn Meal.	Wheat Shorts.	Hay.	Ensilage.	Morning.	Evening.	Total.		
June 1, . .	6½	–	7	37	8	7	15	16 7	–
2, . .	"	–	8	28	8	7	15	16.4	–
3, . .	"	–	7	35	8½	7	15½	16.7	852½
4, . .	"	–	6	40	8½	8	16½	16.2	–
5, . .	"	–	5	40	8	8	16	15.3	–
6, . .	"	–	7	40	9	8	17	17.1	–
7, . .	"	–	7	40	9	8½	17½	17.1	–
8, . .	"	–	5	40	10½	8	18½	15.3	–
9, . .	"	6½	5	40	10	9	19	21.0	–
10, . .	"	"	7	40	10	8½	18½	22.8	–
11, . .	"	"	7	40	10	9	19	22 8	–
12, . .	"	"	7	40	9½	9	18½	22.8	–
13, . .	"	"	6	40	10	9	19	21.9	–
14, . .	"	"	6	40	10	9	19	21.9	–
15, . .	"	"	7	40	10	9	19	22.8	–
16, . .	"	"	7	40	10	10	20	22.8	–
17, . .	"	"	16	40	10	10	20	25.7	895
18, . .	"	"	14	Discontinued; ensilage exhausted.	9½	9	18½	23.9	–
19, . .	"	"	13		9½	9	18½	23.0	–
20, . .	"	"	13		9½	9	18½	23.0	–
21, . .	"	"	14		9½	9	18½	23.9	–
22, . .	"	"	14		9½	9	18½	23.9	–
23, . .	"	"	15		9	9	18	24.8	–
24, . .	"	Discontinued.	*16		10	9	19	20.0	902
25, . .	"		*20		9½	9	18½	23.6	–
26, . .	"		*16		9½	9	18½	20.0	–
27, . .	"		*20		9	9	18	23.6	–
28, . .	"		*20		9½	9	18½	23.6	–
29, . .	"		*20		9½	9	18½	23.6	–
30, . .	"		*20		9	9	18	23.6	–

*New hay.

Analyses of Milk.

	June 16.	June 20.
Water,	86.89	87.20
Solids,	13.11	12.80
Fat (in solids),	3.81	3.83

III. — NAME, CLARA.

Record of Month of May.

1884. FEEDING PERIOD.	FOOD CONSUMED (LBS.) PER DAY.			MILK PRODUCED (LBS.) PER DAY.		Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).
	Indian Meal.	English Hay.	Ensilage.	Morning.	Evening.	
PERIODS.						
May 1–6,	6½	7	33½	8⅓	7½	16.3
6–12,	6½	7	29½	8	7	15 8
12–18,	6½	5⅛	34⅓	7⅔	7	14.9
18–31,	6½	5⅓	28	7	6½	14.1

The experiment with Clara was discontinued at the end of this month on account of her distaste for ensilage.

Analyses of Milk.

	May 3.	May 7.	May 12.	May 20.	May 23.	May 26.
Water,	87.25	87.39	87.20	87.69	87.88	87.97
Solids,	12.75	12.61	12.80	12 31	12.12	12.03
Fat (in solids),	3.68	3.62	3.66	3.47	3.21	3.47

Mean of three last stated Analyses of Milk.

Water,	87.85
Total solids,	12.15
Fat (in solids),	3.39

Melia (IV.) takes the place of Clara.

IV. — Record of MELIA.

Ayrshire; 11 years old; dropped last calf Feb. 15, 1884.

[Melia consumed larger quantities of ensilage, and has taken the place of III. (Clara) in our previous feeding.]

	Feed Consumed (lbs.) per Day.				Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal.
	Corn Meal.	Wheat Shorts.	Hay.	Ensilage.	Morning.	Evening.	Total.		
June 1, . .	–	–	–	–	–	–	–	–	–
2, . .	–	–	–	–	–	–	–	–	–
3, . .	6½	–	7	20	14	13½	27½	14.5	692½
4, . .	"	–	6	40	15	14½	29½	16.2	–
5, . .	"	–	5	40	14	14	28	15.3	–
6, . .	"	–	5	40	15	13½	28½	15.3	–
7, . .	"	–	6	40	14	13½	27½	16.2	–
8, . .	"	–	5	40	15½	12	27½	15.3	–
9, . .	"	6½	6	50	14	13	27	23.2	–
10, . .	"	"	5	58	14	12½	26½	23.4	–
11, . .	"	"	5	59	14½	13	27½	23.5	–
12, . .	"	"	5	60	15	12	27	23.6	–
13, . .	"	"	6	60	14½	12	26½	24.5	–
14, . .	"	"	5	60	14	13	27	23.6	–
15, . .	"	"	5	60	14	13	27	23.6	–
16, . .	"	"	5	60	14	14	28	23.6	–
17, . .	"	"	12	Discontinued; stock of ensilage exhausted.	13½	14	27½	22.1	755
18, . .	"	"	14		13	14	27	23.9	–
19, . .	"	"	12		13½	13	26½	22.1	–
20, . .	"	"	12		13½	13	26½	22.1	–
21, . .	"	"	12		14	12	26	22.1	–
22, . .	"	"	14		14	13	27	23 9	–
23, . .	"	"	14		13	13	26	23.9	–
24, . .	"	Discontinued.	*16		14	12	26	20.0	760
25, . .	"		*19		14	12	26	22.7	–
26, . .	"		*16		13	11½	24½	20.0	–
27, . .	"		*20		13	11	24	23.6	–
28, . .	"		*20		12	11	23	23.6	–
29, . .	"		*20		12	11	23	23.6	–
30, . .	"		*20		12	10½	22½	23.6	–

* New hay.

Analyses of Milk.

	June 16.	June 30.
Water, ...	87.84	88.29
Solids, ...	12.16	11.71
Fat (in solids), ...	3.21	2.99

Summary of Observations under Existing Circumstances.

1. The cows differed widely in their preference for ensilage.

2. Reducing the ensilage to the same state of dryness noticed in the hay, we find that the total quantity of *dry vegetable matter* previously consumed has been considerably reduced, in consequence of the introduction of the ensilage. This is more apparent in Nos. II. and III., than in No. I.

3. The quantity of milk has, in every instance, increased, in consequence of the addition of ensilage to *our customary mode of feeding*, counting the amount of dry vegetable matter, in each case, pound for pound with the milk produced.

4. The increase in quantity of milk, counting on the basis of the total amount of fodder consumed, was most pronounced in case of moderate quantities of ensilage, i. e., from thirty-five to forty pounds per day.

5. The addition of a liberal amount of wheat shorts (bran) to the daily diet (9th of June), has, in most instances, but slightly affected the absolute yield of milk for the better; and has at no time changed the relative proportions between dry vegetable matter and the yield of milk, in favor of the former, as compared with the feeding of corn ensilage alone as an essential additional constituent of the original daily diet. The main benefit derived from the addition of wheat shorts to the daily fodder rations, consisted, evidently, in the improved appearance of the cows, in the improvement of the milk, and in an increased value of the manure resulting.

The quality of milk was not perceptibly changed, as far as the *density and the amount of fat was concerned*, with the exception, when a liberal amount of shorts were fed. None of the mean results obtained after feeding ensilage have been below the lowest results before its introduction in the daily diet.

In stating the composition of milk, only, with reference to water, solid matter and fat, it has been by no means assumed,—in following thereby the common usage,—that the information regarding these points suffices, under all circumstances, to establish the normal character of a sample of milk. The total amount and the relative proportions of the various nitrogenous constituents of the milk,— commonly stated by the collective name, casein,—are known to affect, at times, seriously its character.

Observations in that direction quite naturally suggest themselves in the course of our investigation. The results thus far obtained are, however, for various reasons beyond our control, not decisive enough to question, at the present stage of our work, seriously, the good quality of the milk obtained in connection with the feeding of a moderate amount of corn ensilage. The total amount of nitrogenous matter (crude casein) noticed in case of cow No. II. (May 11 and 26) differed but slightly in different samples as far as its absolute quantity and the relative proportions of casein, albumen and lactoprotein are concerned. The milk of cow No. I., the largest consumer of ensilage, showed a somewhat larger amount of total nitrogenous matter, as compared with that from cow No. II.; and the albumen and lactoprotein showed a marked increase. Whether these results will prove hereafter to be merely of an incidental character, or will have to be ascribed to an excessive consumption of ensilage, farther studies at the earliest suitable occasion are designed to show.

The financial side of the ensilage feeding is not discussed in this connection on account of the absence of exact figures regarding the cost of our ensilage.

The analyses of the various articles of fodder used in above stated feeding experiments, — corn ensilage, timothy hay, wheat shorts, and corn meal,— are as follows: —

ENSILAGE OF CORN IN TASSEL.

[Sample taken from Silo when opened, April 29th.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	86.88	1,737.6	–	–	
Dry Matter,	13.12	262.4	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.89	137.8	–	–	
" Cellulose,	33.66	673.2	484.70	72	1 : 6.57
" Fat,	3.88	77.6	58.20	75	
" Protein (Nitrogenous Matter),	12.58	251.6	183.67	73	
Non-nitrogenous Extract Matter,	42.99	859.8	576.06	67	
	100.00	2,000.0	1,302.63	–	

The silo which furnished this ensilage has been described in the first Annual Report of the station. The fodder corn which filled the silo was well tasselled out, and had, a few days previously, suffered from a severe frost on the night of September 3d ; it had been cut into pieces from two to three inches in length, before it had been tramped down, covered and subjected to a pressure of sixty pounds to a square foot of surface. The silo was opened for the use of its contents on April 29th. The color of the ensilage was dark yellowish green ; it had an acid taste and odor. On the top of the mass and around its sides could be noticed, for some inches in thickness, some mould. The main bulk of the mass — judging from the opinion expressed by many visitors to the station, who claimed to be familiar with the usual appearance of corn ensilage — corresponded evidently with a large proportion of the ensilage fed during the past.

A comparison of the above stated analysis of the dried ensilage, with an analysis of the frost-bitten corn fodder collected at the time the silo was being filled, shows a decrease of non-nitrogenous constituents, except in the case of fat; and a decided increase in nitrogenous matter (crude

protein). The nutritive properties of the corn fodder had been greatly modified in consequence of its treatment in the silo; its nutritive ratio (i. e., relation of nitrogen-containing food constituents to non-nitrogen-containing constituents) had been raised to that of our better grasses.

This result is not an exceptional one *in character;* it is only marked *in degree*, judging from well-endorsed observations in competent hands elsewhere, and is coöperated in the case of all kinds of ensilage. Yet these changes in quality are accompanied by a considerable destruction of valuable organic matter. The fact that the nitrogenous constituents (crude protein) resist better the destructive influences in the ordinary silo, than the non-nitrogenous plant constituents, as starch, sugar, cellulose, etc., is the real cause of the alteration in the nutritive character of the fodder, in consequence of our present management of the silo. An analysis of the liquid, which, under a partial pressure upon our ensilage, accumulated upon the cleaned floor of the silo, admits of no other explanation.

The investigation of the production of a good ensilage, together with a determination of cost as compared with hay, will be resumed at an early date.

Liquid of Ensilage taken from the Bottom of the Silo.

Specific gravity at 20° C., 1.025 ; 102.5 grams of solution required $\frac{1}{2}$ gram of carbonate of soda for its neutralization.

Moisture at 100° C.,	81.52
Dry matter,	18.38
	100.00

Analysis of Dry Matter.

Sesquioxide of iron,	.04
Calcium oxide,	.85
Magnesium oxide,	1.07
Phosphoric acid,	.20
Potassium oxide,	.81
Sodium oxide,	.16
Nitrogen,	.59

Of the nitrogen found in the liquid .246 parts was present in form of soluble albuminoids and .344 parts in form of ammonia compounds. The liquid contained from three to four per cent. more of solid matter than the original corn fodder.

CORN FODDER (Frost-bitten).
(IN TASSEL).
[From Experimental Plats of the Station, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	8.83	176.6	–	–	1 : 9.83
Dry Matter, ...	91.17	1,823.4	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	4.86	97.2	–	–	
" Cellulose, . . .	29.05	581.0	418.32	72	
" Fat, ...	2.06	41.2	30.90	75	
" Protein (Nitrogenous Matter), ...	8.63	172.6	126.00	73	
Non-nitrogenous Extract Matter, ...	55.40	1,108.0	742.36	67	
Total, ...	100.00	2,000.0	1,317 58	–	

This corn fodder served for the production of the previously described corn ensilage. Its frost-bitten condition, and *half matured stage of growth*, have, no doubt, seriously affected the quality and quantity of the ensilage.

TIMOTHY HAY.
[From the Experimental Farm, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	8.70	174.0	–	–	–
Dry Matter, ...	91.30	1,826.0	–	–	–
	100.00	2,000.0	–	–	–
Analysis of Dry Matter.					
Crude Ash, ...	4.04	80.8	–	–	–
" Cellulose, . . .	36.59	731.8	–	–	–
" Fat, ...	2.12	42.4	–	–	–
" Protein (Nitrogenous Matter), ...	7.24	144.8	–	–	–
Non-nitrogenous Extract Matter, ...	50.01	1,000.2	–	–	–
Total, ...	100.00	2,000.0	–	–	–

The hay was harvested in July, after blooming. The sample was taken from the barn in November. The article can scarcely be called a fair average quality of its kind.

CORN MEAL.

[From John L. Holley, South Amherst, Mass.]

Ninety-two per cent. passing through mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	13.85	271.0	–	–	1 : 9.66
Dry Matter,	86.45	1,729.0	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.42	28.4	–	–	
" Cellulose,	2.64	52.8	17.95	34	
" Fat,	4.24	84.4	64 45	76	
" Protein (Nitrogenous Matter),	10.40	208.0	176.80	85	
Non-nitrogenous Extract Matter,	81.30	1,626.0	1,528.44	94	
Total,	100.00	2,000.0	1,787.64	–	

A fair article of its kind.

WHEAT BRAN.

[From John L Holley, South Amherst, Mass.]

Thirty-three per cent. passed through mesh 144 to the square inch (May and June).

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.08	241.6	–	–	1 : 4.16
Dry Matter,	87.92	1,758.4	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.92	158.4	–	–	
" Cellulose,	13.72	274.4	54.88	20	
" Fat,	3.81	76.2	60.96	80	
" Protein (Nitrogenous Matter),	15.67	313.4	275.79	88	
Non-nitrogenous Extract Matter,	58.88	1,177.6	942.08	80	
Total,	100.00	2,000.0	–	–	

This quality of wheat bran, which is of a fair composition, has been used in the previously described feeding experiments.

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2. Notes on Feeding Experiments with Gluten Meal as a Constituent of the Daily Diet of Milch Cows.

The experiment was instituted for the purpose of studying the effect of gluten meal as a constituent of the daily diet of milch cows, on the quantity and the quality of milk obtained, as well as on the cost of its production under several specified circumstances. The same cows which served in the previous trial with corn ensilage, Indian meal, wheat bran and hay, were used in that with gluten meal.

The observations extended over a period of three months. The third period of feeding was not extended beyond two weeks, on account of the bad influence of a too liberal supply of nitrogenous constituents in the daily diet, during very warm weather, on the general condition of the cows.

The mode of feeding was essentially the same as reported on previous occasions. The gluten meal was fed with an equal weight of wheat bran to compensate its deficiency in phosphates of lime and magnesia, and to render it more palatable. The designed amount of both substances was in each instance mixed and moistened, and fed in two meals during milking; the hay followed, mornings, noons and after milking evenings; care being taken to ascertain by weight, before and after meals the exact amount consumed.

The composition and the general character of the gluten meal is described in a few subsequent pages. The cost of the daily fodder rations used in these experiments, are based on our local market prices: gluten meal, $22.50; wheat bran, $23, and hay $15 per ton. Corn meal has cost, during our trials, $28 per ton. It has been the aim, in our subsequent statement of results, to render prominent the controlling influence of the daily yield of milk on its cost under a corresponding system of feeding. It will be noticed, in our trials, that under nearly identical conditions, as far as kind of fodder and period of milking are concerned, the milk of

one cow, as compared with that of another one, may cost the owner of the animals from forty to ninety per cent. and more in one case than in the other. A careful comparison of the subsequent detailed statement of our late experiment with the previous one, tends to show that a good gluten meal. at the stated cost, ought to be considered a valuable addition to our commercial concentrated fodder articles. The rations fed during the first feeding period and at the close of the experiment (IV. Period), deserve from a standpoint, a trial on the part of dairymen. Our results were satisfactory as far as the yield of milk of a good quality is concerned.

I. — Record of Melia.

FEEDING (1.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
July 1–8,	$3\frac{1}{4}$	$3\frac{1}{4}$	20	13	$12\frac{4}{7}$	$25\frac{4}{7}$	23.97	$782\frac{1}{2}$
8–15,	$3\frac{1}{4}$	$3\frac{1}{4}$	20	$14\frac{2}{7}$	13	$27\frac{2}{7}$	23.97	$782\frac{1}{2}$
15–22,	$3\frac{1}{4}$	$3\frac{1}{4}$	20	$13\frac{5}{7}$	$12\frac{5}{7}$	$26\frac{3}{7}$	23.97	$782\frac{1}{2}$
22–29,	$3\frac{1}{4}$	$3\frac{1}{4}$	20	$14\frac{1}{7}$	13	$27\frac{1}{7}$	23.97	$762\frac{1}{2}$
29–Aug. 5,	$3\frac{1}{4}$	$3\frac{1}{4}$	20	$14\frac{3}{7}$	$13\frac{6}{7}$	$28\frac{2}{7}$	23.97	795

Amount of Digestible Matter contained in the Food consumed.

AMOUNT OF FODDER CONSUMED DURING THE 1st PERIOD.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
$113\frac{3}{4}$ lbs. Gluten Meal,	100.46	26.44	62.15	3.40	1 : 6.32
$113\frac{3}{4}$ lbs. Shorts,	101.84	20.25	54.93	4.34	
700 lbs. Hay,	626.15	35.99	358.64	8.53	
Total,	828.45	82.68	475.72	16.27	

Analyses of Milk.

	July 12.	July 22.	July 28.	Aug. 4.
Water,	88.15	87.30	87.40	87.92
Solids,	11.85	12.70	12.60	12.08
Fat (in solids),	3.28	3.14	3.48	3.20

Cost of Fodder Consumed during the 1st Feeding Period.

113¾ lbs. Gluten Meal,	$1 27
113¾ lbs. Shorts,	1 31
700 lbs. Hay,	5 25
Total, 927½ lbs.	$7 83

Daily produce of milk,	26.7 lbs., 13.36 qts.
Cost of daily fodder,	22.4 cents.
Cost of fodder per quart of milk,	1.68 cents.

Record of Melia — Continued.

FEEDING (2.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
Aug. 5–12,	6½	3¼	18 4/7	14 4/7	13 3/7	28	25.50	777
12–19,	6½	3¼	19 3/7	15	13	28	26.33	782
19–26,	6½	3¼	15 6/7	13 3/7	13 5/7	27 1/7	23.10	795
26–Sept. 2,	6½	3¼	19 3/7	14	12 2/7	26 2/7	26.33	827½

Amount of Digestible Matter contained in the Feed consumed.

Amount of Fodder consumed during the 2d Period.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
182 lbs. Gluten Meal,	160.74	43.69	113.83	5.45	1 : 5.32
91 lbs. Shorts,	81.46	16.21	43.94	3.47	
517 lbs. Hay,	462.46	26.58	265.11	6.30	
Total,	704.66	86.48	422.88	15.22	

Analysis of Milk, Aug. 11.

Water,	87.15
Solids,	12.85
Fat (in solids),	3.49

Cost of Fodder consumed during the 2d Feeding Period.

182 lbs. Gluten Meal,	$2 04
91 lbs. Shorts,	1 05
517 lbs. Hay,	3 88
Total, 790 lbs.,	$6 97

Cost of fodder per day,	24.9 cents.
Average produce of milk per day,	27.36 lbs., 13.68 quarts.
Cost of fodder per quart of milk,	1 82 cents.

Record of Melia — Continued.

FEEDING (3.)	FEED CONSUMED (LBS.) PER DAY			MILK PRODUCED (LBS.) PER DAY.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
WEEKS.								
Sept. 2–9,	6½	6½	14 2/7	14 1/7	12	26 1/7	24.50	784
9–16,	6½	6½	13 5/7	12	10 8/7	22 8/7	23.97	815

Amount of Digestible Matter contained in the Food consumed.

AMOUNT OF FODDER CONSUMED DURING THE 3D PERIOD.	Total Dry Matter.	DIGESTIBLE MATTER.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
91 lbs. Gluten Meal,	80.37	21 85	56.92	2.73	1 : 4.42
91 lbs. Shorts,	81.56	16.21	43.94	3 47	
196 lbs. Hay,	175.32	10.08	100.30	2.39	
Total,	237.25	48.14	201.16	8.59	

Analysis of Milk, Sept. 10.

Water,	87.60
Solids,	12.40
Fat (in solids),	3.55

Cost of Fodder consumed during the 3d Feeding Period.

91 lbs. Gluten Meal,	$1 02
91 lbs. Shorts,	1 05
196 lbs. Hay,	1 47
Total, 378 lbs.,	$3 54

Cost of fodder per day,	25.3 cents.
Average produce of milk per day,	24.3 lbs., 12.15 quarts.
Cost of fodder per quart of milk,	2.08 cents.

Record of Melia — Concluded.

FEEDING (4.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
Sept. 16–23,	3¼	3¼	19.4	12.86	11	23.86	23.42	845
23 to Oct. 1,	3¼	3¼	20.0	13.36	12	25.36	23.97	790

Amount of Digestible Matter contained in the Food consumed.

Amount of Fodder consumed during the 4th Period.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
45.5 lbs. Gluten Meal,	40.18	10.93	28.46	1.37	1 : 6.25
45.5 lbs. Shorts,	40.73	8.11	21.97	1.73	
276 lbs. Hay,	246.88	14.19	141.41	3.36	
Total,	327 79	33 23	191.84	6.46	

Analyses of Milk.

	Sept. 17.	Sept. 30.
Water,	87.48	87.56
Solids,	12.52	12.44
Fat (in solids),	3.26	3.14

Cost of Fodder consumed during the 4th Feeding Period.

45.5 lbs. Gluten Meal, ...	$0 51
45.5 lbs Shorts, ...	52
276 lbs. Hay, ...	2 07
Total, 367 lbs., ...	$3 10

Cost of fodder per day, ...	22.14 cents.
Average production of milk per day, . . .	24.6 lbs., 12.32 quarts.
Cost of fodder per quart of milk, ...	1.8 cents.

II. — Record of Nellie May.

FEEDING (1.)	FEED CONSUMED (LBS.) PER DAY.			MILK PRODUCED (LBS.) PER DAY.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
WEEKS.								
July 1–8, . .	3¼	3¼	20	9 5/7	9 2/7	19	23.97	925
8–15, . .	3¼	3¼	20	10	9 1/7	19 1/7	23.97	917
15–22, . .	3¼	3¼	20	10	9 1/7	19 1/7	23.97	900
22–29, . .	3¼	3¼	20	9 6/7	8 3/7	18 2/7	23.97	892
29 to Aug. 5, .	3¼	3¼	20	9 4/7	8 1/7	17 5/7	23.97	937

Amount of Digestible Matter contained in the Food consumed.

AMOUNT OF FODDER CONSUMED DURING THE 1ST PERIOD.	Total Dry Matter.	DIGESTIBLE MATTER.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
113¾ lbs. Gluten Meal, .	100.46	26.44	62.15	3.40	1 : 6.32
113¾ lbs. Shorts, . .	101.84	20.25	54.93	4.34	
700 lbs. Hay, . . .	626.15	35.99	358.64	8.53	
Total, ...	828.45	82.68	475.72	16.27	

Analyses of Milk.

	July 12.	July 22.	July 28.
Water, . . .	87.11	86.73	86.49
Solids, ...	12.89	13.27	13.51
Fat (in solids), ...	3.86	3.61	4.01

Cost of Fodder consumed during the 1st Feeding Period.

113¾ lbs. Gluten Meal, ...	$1 27
113¾ lbs. Shorts, ...	1 31
700 lbs. Hay, ...	5 25
Total, 927½ lbs., ...	$7 83

Daily produce of milk, ... 18.63 lbs., 931 quarts.
Cost of fodder per day, ... 22.4 cents.
Cost of fodder per quart of milk, ... 2.41 cents.

Record of Nellie May — Continued.

FEEDING (2.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
Aug. 5–12, . .	6½	3¼	20	8 4/7	8	16 4/7	26.86	945
12–19, . .	6½	3¼	20	8 5/7	8	16 5/7	26.86	945
19–26, . .	6½	3¼	19 3/7	8	7	15	26.86	960
26 to Sept. 1, .	6½	3¼	20	8 1/7	7 1/7	15 2/7	26.86	977

Amount of Digestible Matter contained in the Food consumed.

Amount of Fodder consumed during the 2d Period.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
182 lbs. Gluten Meal, .	160.74	43.69	113.83	5.45	1 : 5.15
91 lbs. Shorts, . . .	81.46	16.21	43.94	3.47	
556 lbs. Hay, ...	497.34	28.59	284.86	6 78	
Total, ...	739.54	88.49	442.63	15.70	

Analyses of Milk.

	Aug. 5.	Aug. 11.
Water, ...	86.77	86.75
Solids, ...	13.23	13.25
Fat (in solids), ...	4.01	4.06

Cost of Fodder consumed during the 2d Feeding Period.

182 lbs. Gluten Meal, ...	$2 04
91 lbs. Shorts, ...	1 05
556 lbs. Hay, ...	4 17
Total, 829 lbs., ...	$7 26

Cost of fodder per day, ... 25.93 cents.
Average produce of milk per day, . . 15.9 lbs., or 7 95 quarts.
Cost of fodder per quart of milk, ... 3.38 cents.

Record of Nellie May — Continued.

FEEDING (3.)	FEED CONSUMED (LBS.) PER DAY.			MILK PRODUCED (LBS.) PER DAY.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
WEEKS.								
Sept. 2–8, . .	$6\frac{1}{2}$	$6\frac{1}{2}$	$19\frac{1}{7}$	$8\frac{1}{7}$	$7\frac{5}{7}$	$15\frac{6}{7}$	28.95	955
8–15, . .	$6\frac{1}{2}$	$6\frac{1}{2}$	$18\frac{2}{7}$	$7\frac{3}{7}$	$6\frac{3}{7}$	$13\frac{6}{7}$	28.95	985

Amount of Digestible Matter contained in the Food consumed.

AMOUNT OF FODDER CONSUMED DURING THE 3D PERIOD.	Total Dry Matter.	DIGESTIBLE MATTER.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
91 lbs. Gluten Meal, .	80.37	21.85	56.92	2.73	1 : 5.1
91 lbs. Shorts, . .	81.56	16.21	43.94	3.47	
270 lbs. Hay, . . .	239.52	13.88	139.27	3.29	
Total, . . .	401.45	51.94	240.13	9.49	

Analysis of Milk Sept. 10.

Water,	85.18
Solids,	14.82
Fat (in solids),	4.59

Cost of Fodder consumed during the 3d Feeding Period.

91 lbs. Gluten Meal,	$1 02
91 lbs. Shorts,	1 05
270 lbs. Hay,	2 03
Total, 452 lbs.	$4 10

Average produce of milk per day,	14.18 lbs., 7.09 quarts.
Cost of fodder per day,	29.3 cents.
Cost of fodder per quart of milk,	4.13 cents.

Record of Nellie May — Concluded.

FEEDING (4.)	FEED CONSUMED (LBS.) PER DAY.			MILK PRODUCED (LBS.) PER DAY.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
WEEKS.								
Sept. 15–22,	$3\frac{1}{4}$	$3\frac{1}{4}$	$17\frac{3}{7}$	$6\frac{4}{7}$	$5\frac{4}{7}$	$12\frac{1}{7}$	21.67	$1,002\frac{1}{2}$
22–29,	$3\frac{1}{4}$	$3\frac{1}{4}$	20	$6\frac{6}{7}$	$6\frac{6}{7}$	$14\frac{2}{7}$	23.97	1,005

Amount of Digestible Matter contained in the Food consumed.

AMOUNT OF FODDER CONSUMED DURING THE 4TH PERIOD.	Total Dry Matter.	DIGESTIBLE MATTER.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
$45\frac{1}{2}$ lbs. Gluten Meal,	40.18	10.93	28.46	1.37	1 : 6.11
$45\frac{1}{2}$ lbs. Shorts,	40.73	8.11	21.97	1.73	
274 lbs. Hay,	245.09	14.84	140.38	3.34	
Total,	326.00	33.88	190.81	6.44	

Analysis of Milk.

	Sept. 17.	Sept. 30.
Water,	85.04	85.92
Solids,	14.96	14.08
Fat (in solids),	4.36	4.45

Cost of Fodder consumed during the 4th Feeding Period.

45½ lbs. Gluten Meal,	$0 51
45½ lbs. Shorts,	52
274 lbs. Hay,	2 06
Total, 365 lbs.,	$3 09

Average produce of milk per day,	13.46 lbs., 6.82 quarts.
Cost of fodder per day,	22.1 cents.
Cost of fodder per quart of milk,	3.25 cents.

III. — Record of Fairy.

Feeding (1.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
July 1–8,	3¼	3¼	20	10 1/7	9 4/7	19 5/7	23.97	907
8–15,	3¼	3¼	20	10 6/7	10 1/7	21	23.97	927
15–22,	3¼	3¼	20	10 6/7	10	20 6/7	23.97	912½
22–29,	3¼	3¼	20	10 2/7	9 2/7	19 4/7	23.97	902
29–Aug. 4,	3¼	3¼	20	10 1/7	9	19 1/7	23.97	935

Amount of Digestible Matter contained in the Fodder consumed.

AMOUNT OF FODDER CONSUMED DURING THE 1ST PERIOD.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
113¾ lbs. Gluten Meal,	100.46	26.44	62.15	3.40	1 : 6.32
113¾ lbs. Shorts,	101.84	20.25	54.93	4.34	
700 lbs. Hay,	626.15	35.99	358.64	8.53	
Total,	828.45	82.68	475.72	16.27	

Analyses of Milk.

	July 12.	July 22.	July 28.	Aug. 4.
Water,	87.05	86.42	86.82	86.79
Solids,	12.95	13.58	13.18	13.21
Fat (in solids),	3.76	3.73	3.67	3.81

Cost of Fodder consumed during the 1st Feeding Period.

113¾ lbs. Gluten Meal,	$1 27
113¾ lbs. Shorts,	1 31
700 lbs. Hay,	5 25
Total, 927½ lbs.,	$7 83

Average produce of milk per day,	20.1 lbs., 10 quarts.
Cost of fodder per day,	22.4 cents.
Cost of fodder per quart of milk,	2.24 cents.

Record of Fairy — Continued.

FEEDING (2.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
Aug. 4–11,	6½	3¼	20	10 3/7	9 4/7	20	26.86	942
11–18,	6½	3¼	20	10 5/7	9 5/7	20 3/7	26.86	952
18–25,	6½	3¼	19 3/7	9 6/7	9	18 6/7	26.26	965
25–Sept. 1,	6½	3¼	19 5/7	10	8 5/7	18 5/7	26.67	1,027½

Amount of Digestible Matter contained in the Fodder consumed.

Amount of Fodder consumed during the 2d Period.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
182 lbs. Gluten Meal, .	160.74	43.69	113.83	5.45	1 : 5.45
91 lbs. Shorts, . . .	81.46	16.21	43.94	3.47	
554 lbs. Hay, . . .	495.55	28.48	283.83	6.75	
Total, ...	737.75	88.38	441.60	15.67	

Analysis of Milk, Sept. 11.

Water,	86.39
Solids,	13 61
Fat (in solids),	3.91

Cost of Fodder consumed during the 2d Feeding Period.

182 lbs. Gluten Meal,	$2 04
91 lbs. Shorts,	1 05
554 lbs. Hay,	3 79
Total, 827 lbs.,	$6 88

Average produce of milk per day,	19.5 lbs., 9.75 quarts.
Cost of fodder per day,	24.6 cents.
Cost of fodder per quart of milk,	2.52 cents.

Record of Fairy — Continued.

Feeding (3.)	Feed Consumed (lbs.) per Day.			Milk Produced (lbs.) per Day.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
Weeks.								
Sept. 1–8, . .	6½	6½	20	9 3/7	8 4/7	18	29.71	1,002½
8–15, . .	6½	6½	16 4/7	9 1/7	7 6/7	17.	26.65	1,000

Amount of Digestible Matter contained in the Fodder consumed.

AMOUNT OF FODDER CONSUMED DURING THE 3D PERIOD.	Total Dry Matter.	DIGESTIBLE MATTER.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
91 lbs. Gluten Meal, .	80.37	21.85	56.92	2.73	1 : 4.96
91 lbs. Shorts, . .	81.56	16.21	43.49	3.47	
251 lbs. Hay, . . .	224.52	12.90	128 59	3.06	
Total, ...	386.45	50.96	229 45	9.26	

Analysis of Milk Sept. 10.

Water, ...	85.60
Solids, ...	1.05
Fat (in solids), ...	1.88

Cost of Fodder consumed during the 3d Feeding Period.

91 lbs. Gluten Meal, ...	$1 02
91 lbs. Shorts	1 05
251 lbs. Hay, ...	1 88
Total, 433 lbs., ...	$3 95

Average produce of milk per day, . . . 14.68 lbs., 7.34 quarts.
Cost of fodder per day, ... 28.2 cents.
Cost of fodder per quart of milk, ... 3.84 cents.

Record of Fairy— Concluded.

FEEDING (4.)	FEED CONSUMED (LBS.) PER DAY.			MILK PRODUCED (LBS.) PER DAY.			Amount of dry vegetable matter contained in the daily fodder consumed (lbs.).	Weight of Animal (lbs.).
	Gluten Meal.	Shorts.	English Hay.	Morning.	Evening.	Total.		
WEEKS.								
Sept. 15–22, . .	3¼	3¼	17 5/7	9 5/7	8 5/7	18 3/7	21.96	1,007½
22–29, . .	3¼	3¼	20	10	9	19	23.97	1,035

Amount of Digestible Matter contained in the Fodder consumed.

Amount of Fodder consumed during the 4th Period.	Total Dry Matter.	Digestible Matter.			Nutritive Ratio.
		Protein.	Carb. Hydrates.	Fat.	
45½ lbs. Gluten Meal,	40.18	10.93	28.46	1.37	1 : 6.21
45½ lbs. Shorts,	40.73	8.11	21.97	1.73	
269 lbs. Hay,	240.62	13.83	137.81	3.28	
Total,	321.53	32.87	188.24	6.38	

Analysis of Milk.

	Sept. 17.	Sept. 30.
Water,	85.85	85.99
Solids,	14.15	14.01
Fat (in solids),	4.06	4.11

Cost of Fodder Consumed during the 4th Feeding Period.

45½ lbs. Gluten Meal,	$0 51
45½ lbs. Shorts,	52
269 lbs. Hay,	2 02
Total, 360 lbs.,	$3 05

Average produce of milk per day,	18.9 lbs., 9.45 quarts.
Cost of fodder per day,	21.8 cents.
Cost of fodder per quart of milk,	2.31 cents.

GLUTEN MEAL.

[From Chicago Sugar Refining Company.]

Eighty-five per cent. passsed through mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	11.68	233.6	–	–	1 : 2.92
Dry Matter,	88.32	1,766 4	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash,	0.79	15.8	–	–	
" Cellulose,	0.77	15.4	5.24	34	
" Fat,	3.94	78.8	59.89	76	
" Protein (Nitrogenous Matter),	28.24	564.8	408.08	85	
Non-nitrogenous Extract Matter,	66.26	1,325.2	1,245.69	94	
	100.00	2,000.0	1,790.90	–	

The gluten meal is obtained as a by-product in the manufacture of starch and glucose from corn. It consists mainly of the germs of the latter, with more or less skin parts and starch. The supply of this substance has acquired considerable proportions in consequence of the recent development of the glucose industry in this country.

Examinations of samples from various sources have demonstrated its highly nitrogenous character, and left but little doubt about its value for feeding purposes under suitable circumstances. For details in this direction I refer, as far as my own observations and statements are concerned, to Bulletin I., page 11, and Bulletin V., page 5, or the First Annual Report. The variations noticed in composition are in the main evidently caused by modifications in the manufacturing process, — a circumstance by no means an exceptional one, as far as the gluten meal is concerned; for all our valuable refuse materials for fodder, as brans, oil-cakes, etc., suffer from the same influence. The sample which served for our feeding experiments, and furnished the ma-

terial for the above analysis, was obtained by the following process, according to the kind communication of Dr. A. Behr, the superintendent of the Chicago Sugar Refining Company: "The process mostly followed in starch and glucose works for the separation of starch, includes the use of caustic-soda for dissolving the gluten (nitrogenous constituents of the corn). Our process differs in these particulars, that we do not use any caustic-soda at all, and that we separate the germs of the corn before it is finally ground up. The consequence is, that gluten meal contains no caustic-soda or sodium-salts, and is comparatively poor in fat,— this being for the greater part removed with the germs. The way we proceed is briefly as follows: The water as it comes from the mills and carries the fine starch and gluten in suspension, is run over long slightly inclined troughs, the ordinary "Starch-Tables." Here the heavy starch settles, while the lighter particles, small starch, gluten, fibre and fat are carried away with the water. This mixture is allowed to settle in large vats, the clear water drawn off, and the residue dumped into filter presses. The press cakes are dried in steam driers, ground up in mills, and in this form make the gluten meal."

The calculation of the digestible portion of the gluten-meal is based on that noticed in corn-meal, in actual feeding tests. The numerical relations between the digestible amount of nitrogenous constituents and of carbohydrates or non-nitrogenous constituents in the above sample of gluten meal (1 : 2.92), corresponds quite closely with that in a fair sample of pease; its mineral constituents are, however, but one-fifth of that of the latter.

The article is offered for sale by the carload in bulk at $21 per ton, or $22.50 in bags, at Boston railroad depots; similar charges have been made in Springfield.

The analyses of Wheat Bran and Timothy Hay, below stated, refer to the materials used in this experiment.

WHEAT BRAN.

[From JOHN L. HOLLEY, South Amherst, Mass.]

13.71 per cent. passed through mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.48	209.6	–	–	1 : 3.25
Dry Matter,	89.52	1,790.4	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.98	139.6	–	–	
" Cellulose,	10.20	204.0	40.80	20	
" Fat,	4.77	95.4	76.32	80	
" Protein (Nitrogenous Matter,	20.24	404.8	356.22	88	
Non-nitrogenous Extract Matter,	57.81	1,156.2	924.96	80	
	100.00	2,000.0	1,398.3	–	

The article sold at $23 per ton at the mill.

TIMOTHY HAY.

[From the grounds of the Experiment Station, June 20, 1884.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.55	211.0	–	–	1 : 10.6
Dry Matter,	89.45	1,789.0	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash,	4.69	93.8	–	–	
" Cellulose,	29.21	584.2	338.84	58	
" Fat,	2.65	53.0	24.38	46	
" Protein (Nitrogenous Matter,	9.02	180.4	102.83	57	
Non-nitrogenous Extract Matter,	54.43	1,088.6	685.82	63	
	100.00	2,000.0	1,151.87	–	

The grass was cut at the close of the blooming period, and the hay is a fair article of its kind.

SUMMARY OF THE INFLUENCE OF FEED ON THE COMPOSITION OF MILK.

NELLIE MAY.—Breed, grade Ayrshire; age, 4 years; dropped last calf Feb. 1, 1884.

Year and Month.	Feed.	Daily Yield of Milk.	Composition of Milk.			
			Water.	Total Solids.	Fat.	Solids not Fat.
1884.						
April 8,	4 qts. Indian meal and hay all she would eat.	15 lbs.	87.57	12.43	3.71	8.72
11,		15 "	87.18	12.82	3.82	9.00
14,		15 "	87.09	12.91	3.87	9.04
16,	5¼ lbs. meal and 15 lbs. hay, .	14 "	87.33	12.67	3.56	9.11
18,	6½ lbs. meal and 17 lbs. hay, .	14 "	87.65	12.35	3.97	8.38
21,		14 "	87.02	12.98	3.99	8.99
May 3,	6½ lbs. meal, 8 lbs. hay and 40 lbs. ensilage.	16 "	87.00	13.00	3.81	8.19
7,		16 "	87.09	12.91	3.91	9.00
12,	6½ lbs. meal, 8 lbs. hay and 40 lbs. ensilage.	15 "	87.43	12.57	3.86	8.71
20,	6½ lbs. meal, 8 lbs. hay and 50 lbs. ensilage.	15 "	87.39	12.61	3.80	8.81
23,	6½ lbs. meal, 8 lbs. hay and 50 lbs. ensilage.	15 "	87.19	12.81	3.68	9.13
26,	6½ lbs. meal, 8 lbs. hay and 50 lbs. ensilage.	15 "	87.37	12.63	3.68	8.95
June 16,	6½ lbs. meal, 8 lbs. hay 6½ lbs. shorts and 40 lbs. ensilage.	20 "	86.89	13.11	3.81	9.30
30,	6½ lbs. meal and 20 lbs. hay, .	18 "	87.20	12.80	3.83	8 97
July 12,	3¼ lbs. wheat shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	19 "	87.11	12.89	3.86	9.03
22,		19 "	86.73	13.27	3.61	9.56
28,		18 "	86.49	13.51	4.01	9.50
Aug. 4,	3¼ lbs. wheat shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	17½ "	86.77	13.23	4.01	9.22
11,	3¼ lbs. wheat shorts, 6½ lbs. gluten meal and 20 lbs. hay.	17 "	86.75	13.25	4.06	9.19
Sept. 10,	6½ lbs. shorts, 6½ lbs. gluten meal and 20 lbs. hay.	15 "	85.18	14.82	4.59	10.23
17,	3¼ lbs. shorts, 3½ lbs. gluten meal and 20 lbs. hay.	12 "	85.04	14.96	4.36	10.60
30,		14 "	85.92	14.08	4.45	9.63

FAIRY.—Breed, grade Ayrshire; age, 5 years; dropped last calf Feb. 25, 1884.

Year and Month.	Feed.	Daily Yield of Milk.	Water.	Total Solids.	Fat.	Solids not Fat.
1884.						
April 8,	4 qts. meal and all hay animal would eat.	19 lbs.	87.46	12.54	3 33	9.21
11,		19 "	87.67	12.33	3.20	9.13
14,	4 qts. meal and all hay animal would eat.	19 "	87.54	12.46	3.34	9.12
16,	5½ lbs. meal and 15 lbs. hay, .	19 "	87.28	12.72	3.49	9.23
18,	6½ lbs. meal and 17 lbs. hay, .	19 "	87 92	12.08	3.32	8.76
21,	6½ lbs. meal and 17 lbs. hay, .	19 "	87.59	12.41	3.64	8.77
May 3,	6½ lbs. meal, 8 lbs. hay and 40 lbs. ensilage.	19 "	87.16	12.84	4 08	8.76
7,		19 "	86.99	13.01	3 88	9.13
12,	6½ lbs. meal, 8 lbs. hay and 40 lbs. ensilage.	19 "	86.84	13.16	3.93	9.13
20,	6½ lbs. meal, 7 lbs. hay and 60 lbs. ensilage.	19 "	87.33	12.67	3.60	9.07
23,		19 "	87.55	12.45	3.29	9.16
26,	6½ lbs. meal, 7 lbs. hay and 60 lbs. ensilage.	18½ "	87.57	12.43	3.37	9.06
June 10,	6½ lbs. corn meal, 6½ lbs. shorts, 7 lbs. hay and 60 lbs. ensilage.	20 "	87.10	12.90	3.61	9.29
16,		21 "	86.60	13.40	3.83	9.57
30,	6½ lbs. meal and 20 lbs. hay, .	20 "	87.36	12.64	3.59	9.05

FAIRY — *Concluded.*

Year and Month.	Feed.	Daily Yield of Milk.	Composition of Milk. Water.	Total Solids.	Fat.	Solids not Fat.
July 12,	3¼ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	21 "	87.05	12.95	3.76	9.19
22,		21 "	86.42	13.58	3.73	9.85
Aug. 4,	3¾ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	19 "	86.79	13.21	3.81	9.40
11,	3¼ lbs. shorts, 6½ lbs. gluten meal and 20 lbs. hay.	21 "	86.39	13.61	3.91	9.70
Sept. 10,	6½ lbs. shorts, 6½ lbs. gluten meal and 20 lbs. hay.	17 "	85.60	14.40	4.84	9 56
30,	3¼ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	19 "	85.99	14.01	4.11	9.90

CLARA. — Breed, grade Ayrshire; age, 5 years; dropped last calf Feb. 25, 1884.

Year and Month.	Feed.	Daily Yield of Milk.	Water.	Total Solids.	Fat.	Solids not Fat.
1884.						
April 8,	4 qts. meal and all the hay the animal would eat.	16 lbs.	88.04	11.96	3.27	8 69
11,		16 "	87.32	12.68	3.48	9.20
14,	4 qts. meal and all the hay the animal would eat.	16 "	87.39	12.61	3.56	9.05
18,	6½ lbs. meal and 15 lbs. hay, .	17 "	87.08	12.92	3 89	9.03
21,	6½ lbs. meal and 15 lbs. hay, .	16 "	87 37	12.63	3 73	8.90
May 3,	6½ lbs. meal, 7 lbs. hay and 30 lbs. ensilage.	15½ "	87 25	12.75	3.69	9.06
7,		15½ "	87.39	12.61	3.62	8.99
12,	6½ lbs. meal, 7 lbs. hay and 30 lbs. ensilage.	15 "	87.20	12.80	3.66	9.14
20,	6½ lbs. meal, 7 lbs. hay and 30 lbs. ensilage.	14 "	87.69	12.31	3.47	8.84
23,	6½ lbs. meal, 7 lbs. hay and 30 lbs. ensilage.	14 "	87.88	12.12	3.21	8.91
26,	6½ lbs. meal, 7 lbs. hay and 30 lbs. ensilage.	13 "	87.97	12.03	3.47	8.56

MELIA. — Breed, Ayrshire; age, 11 years; dropped last calf Feb. 15, 1884.

Year and Month.	Feed.	Daily Yield of Milk.	Water.	Total Solids.	Fat.	Solids not Fat.
1884.						
June 16,	6½ lbs. meal, 6½ lbs. shorts, 5 lbs. hay and 60 lbs. ensilage.	28 lbs.	87.84	12.16	3.21	8.95
30,	6½ lbs. meal and 20 lbs. hay, .	23 "	88.29	11.71	2.99	8 72
July 12,	3¼ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	27 "	88.15	11.85	3.28	8.57
22,		27 "	87.30	12.70	3.14	8 56
28,	3¼ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	27 "	87.40	12.60	3.48	9.12
Aug. 4,	3¼ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	27 "	87.92	12.08	3.20	8.88
11,	3¼ lbs. shorts, 6½ lbs. gluten meal and 20 lbs. hay.	29 "	87.15	12.85	3.49	9.36
Sept. 10,		24 "	87 60	12.40	3 55	8.85
17,	3¼ lbs. shorts, 3¼ lbs. gluten meal and 20 lbs. hay.	22 "	87.48	12.52	3.26	9.26
30,		25 "	87.56	12.44	3.14	9.30
Nov. 18,	3¼ lbs. shorts, 3¼ lbs. meal and 20 lbs. hay.	19 "	87.66	12.34	3.39	8.95
24,		19 "	87.88	12.22	3.48	8.74
Dec. 5,	3¼ lbs. shorts, 3¼ lbs. meal, 3¼ lbs. gluten meal and 15 lbs. hay.	22 "	87.01	12.99	3.55	9 44
10,		22 "	87 27	12 73	3.49	9.24
17,		21 "	87.68	12.32	3 24	9.08
24,	3¼ lbs. shorts, 3¼ lbs. meal and 15 lbs. hay.	20 "	87.31	12.69	3.58	9.11
1885.						
Jan. 7,		16 "	87.49	12.51	3.66	8.85
15,	3¼ lbs. shorts, 3¼ lbs. meal and 15 lbs. hay.	16 "	88.09	11.91	3.33	8.58

BESSIE. — Breed, grade Jersey; age, 5 years; dropped last calf Oct. 17, 1884.

Year and Month.	Feed.	Daily Yield of Milk.	Composition of Milk.			
			Water.	Total Solids.	Fat.	Solids not Fat.
1884.						
Nov. 18,	3¼ lbs. shorts, 3¼ lbs. meal and 16 lbs. hay.	29 lbs.	87.06	12.94	4.04	8.90
24,		21 "	87.91	13.09	3.86	9.13
Dec. 5,	3¼ lbs. shorts, 3¼ lbs. meal, 3¼ lbs. gluten meal and 16 lbs. hay.	29 "	86.18	13.82	4.02	9.80
10,		29 "	86.99	13.01	3.72	9.29
17,	3¼ lbs. shorts, 3¼ lbs. meal, 3¼ lbs. gluten meal and 16 lbs. hay.	28 "	87.41	12.59	3.32	9.27
24,	3¼ lbs. shorts, 3¼ lbs. meal and 15 lbs. hay.	27 "	85.36	14.64	4.75	9.89
1885.						
Jan. 7,	3¼ lbs. shorts, 3¼ lbs. meal and 15 lbs. hay.	24 "	87.26	12.74	3.73	9.01
15,	3¼ lbs. shorts, 3¼ lbs. meal and 15 lbs. hay.	23 "	87.29	12.71	3.91	8.80

LADY HORACE. — Grade Ayrshire; age, 5 years; dropped last calf Oct. 16, 1884.

1884.						
Nov. 18,	3¼ lbs. shorts, 3¼ lbs. meal and 16 lbs. hay.	29 lbs.	86.02	13.98	4.99	8.99
24,		28 "	87.15	12.85	3.65	9.20
Dec. 5,	3¼ lbs. shorts, 3¼ lbs. meal, 3¼ lbs. gluten meal and 20 lbs. hay.	33 "	85.12	14.88	5.10	9.78
10,		34 "	87.20	12.80	3.74	9.06
17,		31 "	87.26	12.74	3.86	8.88
24,	3¼ lbs. shorts, 3¼ lbs. meal and 19 lbs. hay.	29 "	86.22	13.78	4.70	9.08
1885.						
Jan. 7,	3¼ lbs. shorts, 3¼ lbs. meal and 19 lbs. hay.	24 "	87.41	12.59	3.64	8.95
15,	3¼ lbs. shorts, 3¼ lbs. meal and 19 lbs. hay.	24 "	87.05	12.95	3.95	9.00

Observations with Milk.

I. *Influence of Temperature on Specific Gravity.*

Pure milk (Lady Horace): Water, 87.17 per cent.; solids, 12.83 per cent.; fat, 3.69 per cent.; solids not fat, 9.14 per cent.

Temperature, 8.5° C.	Sp. Gr., 1 0350.	*Lactometer, 120.
" 11.5°	" 1.0344.	" 118.
" 14.°	" 1.0338.	" 116.
" 16.5°	" 1.0329.	" 113.
" 19.5°	" 1.0323.	" 111.
" 22.°	" 1.0317.	" 109.
" 24.°	" 1.0314.	" 108.
" 28.3°	" 1.0299.	" 103.
" 30.°	" 1.0293.	" 101.

Pure milk: Water, 87.26 per cent.; solids, 12.74 per cent.; fat, 3.89 per cent.; solids not fat, 8.85 per cent.

Temperature, 7.° C.	Sp. Gr., 1.0353.	Lactometer, 121.
" 9.°	" 1.0353.	" 121.
" 10.°	" 1.0350.	" 120.
" 13.°	" 1.0338.	" 116.
" 14.°	" 1.0335.	" 115.
" 16.°	" 1.0332.	" 114.
" 17.°	" 1.0329.	" 113.
" 19.5°	" 1.0320.	" 110.
" 21.°	" 1.0314.	" 108.
" 23.°	" 1.0311.	" 107.

Pure milk: Water, 86.22 per cent.; solids, 13.78 per fat, 4.70 per cent.; solids not fat, 9.08 per cent.

Temperature, 3.° C.	Sp. Gr., 1.0356.	Lactometer, 122.
" 6.5°	" 1.0353.	" 121.
" 8.5°	" 1.0350.	" 120.
" 11.°	" 1.0347.	" 119.
" 13.5°	" 1.0340.	" 117.
" 16.2°	" 1.0329.	" 113.
" 19.8°	" 1.0320.	" 110.

*The lactometer used in these examinations is Mott's Lactometer, verified by Dr. H. A. Mott of New York City, N. Y.

Pure milk: Water, 87.41 per cent.; solids, 12.59 per cent.; fat, 3.64 per cent.; solids not fat, 8.95 per cent.

Temperature,	11.5° C.	Sp. Gr.,	1.0356.	Lactometer,	122.
"	13.6°	"	1.0350.	"	120.
"	16.°	"	1.0347.	"	119.
"	18.°	"	1.0341.	"	117.
"	18.5°	"	1.0338.	"	116.

Pure milk: Water, 87.05 per cent.; solids, 12.95 per cent.; fat, 3.95 per cent.; solids not fat, 3.00 per cent.

Temperature,	12.5° C.	Sp. Gr.,	1.0338.	Lactometer,	116.
"	15.°	"	1.0332.	"	114.

Pure milk (Bessie): Water, 86.99 per cent.; solids, 13.1 per cent.; fat, 3.72 per cent.; solids not fat 9.29 per cent.

Temperature,	9.° C.	Sp. Gr.,	1.0353.	Lactometer,	121.
"	11.°	"	1.0350.	"	120.
"	14.5°	"	1.0341.	"	117.
"	17.°	"	1.0335.	"	115.
"	19.5°	"	1.0332.	"	114.
"	21.4°	"	1.0323.	"	111.
"	24.9°	"	1.0311.	"	107.
"	27.5°	"	1.0299.	"	103.
"	30.°	"	1.0293.	"	101.

Water, 87.41 per cent.; solids, 12.59 per cent.; fat, 3.29 per cent.; solids not fat, 9.30 per cent.

Temperature,	5.° C.	Sp. Gr.,	1.0365.	Lactometer,	125.
"	8.5°	"	1.0362.	"	124.
"	9.°	"	1.0362.	"	124.
"	12.°	"	1.0353.	"	121.
"	16.°	"	1.0341.	"	117.
"	17.°	"	1.0341.	"	117.
"	20.°	"	1.0329.	"	113.
"	21.°	"	1.0326.	"	112.
"	23.5°	"	1.0317.	"	109.

Water, 85.33 per cent.; solids, 14.67 per cent.; fat, 4.75 per cent.; solids not fat, 9.92 per cent.

Temperature,	1.8° C.	Sp. Gr.,	1.0371.	Lactometer,	127.
"	6.5°	"	1.0365.	"	125.
"	9.°	"	1.0365.	"	125.
"	11.°	"	1.0362.	"	124.
"	13.5°	"	1.0356.	"	122.
"	16.5°	"	1.0344.	"	118.
"	19.5	"	1.0329.	"	113.

Water, 87.27 per cent.; solids, 12.73 per cent.; fat, 3.73 per cent.; solids not fat, 9.00 per cent.

Temperature, 11.5° C.	Sp. Gr., 1.0356.	Lactometer, 122.
" 14.9°	" 1.0350.	" 120.
" 16.5°	" 1.0344.	" 118.
" 18.°	" 1.0341.	" 117.

Water, 87.32 per cent.; solids, 12.68 per cent.; fat, 3.91 per cent.; solids not fat, 8.77 per cent.

Temperature, 13.5° C.	Sp. Gr., 1.0335.	Lactometer, 115.
" 15.°	" 1.0335.	" 115.

Pure milk (Melia): Water, 87.27 per cent.; solids, 12.73 per cent.; fat, 3.49 per cent.; solids not fat, 9.24 per cent.

Temperature, 9.° C.	Sp. Gr., 1.0341.	Lactometer, 117.
" 11.° C.	" 1.0338.	" 116.
" 14.8°	" 1.0332.	" 114.
" 18.°	" 1.0323.	" 111.
" 20.5°	" 1.0320.	" 110.
" 22.°	" 1.0320	" 110.
" 25.°	" 1.0308.	" 106.
" 27.°	" 1.0302.	" 104.
" 29.5°	" 1.0293.	" 101.

Water, 87.67 per cent.; solids, 12.33 per cent.; fat, 3.24 per cent.; solids not fat, 9.09 per cent.

Temperature, 5.° C.	Sp. Gr., 1.0356.	Lactometer, 122.
" 8.8°	" 1.0353.	" 121.
" 12.°	" 1.0341.	" 117.
" 14.°	" 1.0335.	" 115.
" 15.5°	" 1.0332.	" 114.
" 17.°	" 1.0329.	" 113.
" 19.5°	" 1.0317.	" 109.
" 20.5°	" 1.0314.	" 108.

Water, 87.31 per cent.; solids, 12.69 per cent.; fat, 3.57 per cent.; solids not fat, 9.12 per cent.

Temperature, 0.5° C.	Sp. Gr., 1.0356.	Lactometer, 122.
" 5.5°	" 1.0353.	" 121.
" 8.°	" 1.0350.	" 120.
" 10.°	" 1.0350.	" 120.
" 12.5°	" 1.0341.	" 117.
" 15.5°	" 1,0332.	" 114.
" 19.°	" 1.0317.	" 109.

Water, 87.32; per cent.; solids, 12.68 per cent; fat, 3.66 per cent.; solids not fat, 9.02 per cent.

Temperature, 12.° C.	Sp. Gr., 1.0332.	Lactometer, 114.
" 14.°	" 1.0329.	" 113.
" 16.5°	" 1.0326.	" 112.
" 17.7°	" 1.0323.	" 111.

Water, 88.07 per cent.; solids, 11.93 per cent.; fat, 3.33 per cent.; solids not fat, 8.60 per cent.

Temperature, 13.° C.	Sp. Gr., 1.0311.	Lactometer, 107.
" 15.°	" 1.0311.	" 107.

Mixed Milk from Several Cows.

I. Water, 87.50 per cent.; solids, 12.50 per cent.; fat, 3.43 per cent.; solids not fat, 9.07 per cent.

Temperature, 12.° C.	Sp. Gr., 1.0350.	Lactometer, 120.
" 14.5°	" 1.0347.	" 119.
" 15.5°	" 1.0344.	" 118.
" 17.°	" 1.0338.	" 116.
" 18.°	" 1.0335.	" 115.

II. Water, 85.70 per cent.; solids, 14.30 per cent.; fat, 4.90 per cent,; solids not fat, 9.40 per cent.

Temperature, 12.° C.	Sp. Gr., 1.0362.	Lactometer, 124.
" 14.°	" 1.0355.	" 122.
" 16.°	" 1.0345.	" 118.
" 17.°	" 1.0335.	" 115.
" 19.°	" 1.0329.	" 113.
" 22.°	" 1.0323.	" 111.
" 27.°	" 1.0305.	" 105.

III. Water, 86.50 per cent; solids, 13.50 per cent.; fat, 3.88 per cent.; solids not fat, 9.62 per cent.

Temperature, 11.7° C.	Sp. Gr., 1.0365.	Lactometer, 125.
" 13.°	" 1.0359.	" 123.
" 14.°	" 1.0353.	" 121.
" 15.°	" 1.0350.	" 120.
" 16.	" 1.0347.	" 119.
" 18.°	" 1.0343.	" 118.
" 19.2°	" 1.0340.	" 117.
" 20.°	" 1.0338.	" 116.
" 21.°	" 1.0330.	" 114.
" 21.5°	" 1.0330.	" 114.

IV. Water, 85.90 per cent.; solids, 14.10 per cent.; fat, 4.65 per cent.; solids not fat, 9.45 per cent.

Temperature, 11.° C.	Sp. Gr., 1.0362.	Lactometer, 124.
" 13.°	" 1.0353.	" 121.
" 15.°	" 1.0347.	" 119.
" 16.5°	" 1.0343.	" 118.
" 19.°	" 1.0332.	" 114.
" 21.°	" 1.0328.	" 113.
" 22.°	" 1.0323.	" 111.
" 25.°	" 1.0317.	" 109.

V. Water, 86.34 per cent.; solids, 13.66 per cent.; fat, 3.93 per cent.; solids not fat, 9.73 per cent.

Temperature, 11.° C.	Sp. Gr., 1.0371.	Lactometer, 127.
" 13.5°	" 1.0371.	" 127.
" 15.°	" 1.0362.	" 124.
" 16.5°	" 1.0356.	" 122.
" 18.°	" 1.0353.	" 121.
" 21.°	" 1.0341.	" 117.
" 23.°	" 1.0335.	" 115.
" 25.°	" 1.0326.	" 112.

VI. Water, 84.87 per cent.; solids, 15.13 per cent.; fat, 5.49 per cent.; solids not fat, 9.64 per cent.

Temperature, 11.° C.	Sp. Gr., 1.0359.	Lactometer, 123.
" 13.°	" 1.0350.	" 120.
" 14.5°	" 1.0347.	" 119.
" 17.°	" 1.0338.	" 116.
" 18.5°	" 1.0338.	" 116.

PURE MILK (MASSACHUSETTS AGRICULTURAL COLLEGE).

Temperature, 21.° C.	Sp. Gr., 1.032.	Lactometer, 110.
" 14.°	" 1.033.	" 114.
" 10.°	" 1.035.	" 120.
" 7.°	" 1.0355.	" 122.

Increasing temperature of same: —

Temperature, 14.° C.	Sp. Gr., 1.0345.	Lactometer, 116.
" 19.°	" 1.0330.	" 114.
" 21.°	" 1.0325.	" 112.

II. *Influence of Water on the Composition of Milk.*

Milk from Lady Horace: Water, 87.05 per cent.; solids, 12.95 per cent.; fat, 3.95 per cent.; solids not fat, 9.00 per cent.

Added water until the lactometer stood at 100 at 15° C., or 14.5 per cent.

Water,	88.89	per cent.
Solids,	11.11	"
Fat (in solids),	3.31	"
Solids not fat,	7.80	"

Milk from Bessie: Water, 87.29 per cent.; solids, 12.71 per cent.; fat, 3.91 per cent.; solids not fat, 8.80 per cent.

Added water until the lactometer stood at 100 at 15° C., or 15.4 per cent.

Water,	89.03	per cent.
Solids,	10.97	"
Fat (in solids),	3.31	"
Solids not fat,	7.66	"

Milk from Melia: Water, 88.09 per cent.; solids, 11.91 per cent.; fat, 3.33 per cent.; solids not fat, 7.58 per cent.

Added water until the lactometer stood at 100 at 15° C., or 8.7 per cent.

Water,	88.91	per cent.
Solids,	11.09	"
Fat,	3.12	"
Solids not fat,	7.97	"

Pure milk — 1.032 specific gravity at 21° C., 110° lactometer.

$3\frac{2}{3}$ per cent. of water added	21.° C.	1.0315 Sp. Gr.,	or 108	Lactometer.
$6\frac{2}{3}$ " " "	21.°	1.030 "	104	"
10 " " "	21.°	1.029 "	100	"
$16\frac{2}{3}$ " " "	21.°	1.027 "	94	"

III. *Influence of Skimming on the Specific Gravity of Milk.*

Fresh genuine milk stood at —

23.° C.	1.0300 Sp. Gr.,	or	104	Lactometer.
19.°	1.0315	"	108	"
14.°	1.0320	"	110	"

After skimming : —

9.° C.	1.0360 Sp. Gr.,	or	124	Lactometer.
18.°	1.0350	"	120	"
23.°	1.0350	"	120	"

3. Notes on Feeding Experiments with Pigs.

The experiment described in a few subsequent pages is the first of a series planned for the purpose of studying the comparative feeding value of skim-milk and of creamery buttermilk, in connection with corn meal for the production of pork. To secure a suitable basis for the work, it was decided to ascertain first the facts regarding the results of feeding equal measures of skim-milk and of buttermilk, with a corresponding weight of corn meal in both cases. The skim-milk was obtained from the dairy of the college and the station; the buttermilk from the factory of the Amherst Co-operative Creamery Association. The skim-milk was rated at two cents per gallon, and the creamery buttermilk 1.37 cents per gallon, — the contractor's price. Corn meal was bought at $28 per ton. Several analyses of both kinds of milk, and the mean of three analyses of the corn meal fed during the experiment, are stated further on.

The skim-milk contained about 2.5 per cent. more solid matter than the creamery buttermilk, a circumstance due, most likely, to the access of some water from the first washing of the butter.

Six pigs, from forty to fifty pounds in weight (Berkshires), secured from the college farm, were used for the experiment; three of them were fed with skim-milk and corn meal (Lot A), and three with creamery buttermilk and corn meal (Lot B). Each of the two lots consisted of one barrow and

two sows; the former (III.) gave in both lots the best results. The animals were fed alike, in the following way:—One-third of the daily ration of milk was fed with one-half of the daily ration of corn meal at six o'clock, A. M.; one-third of the milk at twelve o'clock, M., without any meal; and the remaining third part of milk with one-half of the meal at six o'clock, P. M. Whenever the previous feed was consumed some hours before a succeeding feeding time, the amount of daily fodder was gradually increased. This rule of feeding was carried out during the entire trial and suffered only a temporary modification in consequence of a few short periods of very hot weather.

At the beginning of the experiment about two ounces of corn meal were fed for every quart of milk, and subsequently three ounces for every quart. This proportion of corn meal to milk produced better results in the case of buttermilk (Lot B) than in the case of skim-milk (Lot A), considering the larger amount of solid matter contained in the latter.

Nearly one-fourth of the solid matter noticed in the skim-milk shows no return of a proportionate increase in live weight, as will be found on comparing the subsequent detailed record. The total live weight and dressed weight of both lots of animals differ only two to four pounds from each other,—the buttermilk leading. The cost of fodder per pound of dressed pork produced, amounts in Lot A (skim-milk) to 5.8 cents, and in case of Lot B (buttermilk) to 4.6 cents.

This difference in cost corresponds quite closely with the difference in cost of the two kinds of milk. The dressed pork was sold at 7½ cents per pound. The value of manure produced will be reported on some later occasion, when actual values can be presented.

The investigation is continued. Two breeds—Berkshire and Chester—are already on trial to turn to account the information received in the first experiment.

[A.]

SKIM-MILK AND CORN MEAL.

I.

PERIODS.	FEED CONSUMED. Meal (ozs.)	Skim-milk (qts.)	Weight of Animal (lbs.)	Daily Increase in Live Weight.
May 21–31,	100	58	41½	0 lbs. 11 ozs.
June 1–9,	132	54	60½	1 " 0 "
9–17,	128	48	67	0 " 15 "
17–24,	152	50	79¾	1 " 13 "
24–30,	160	54	89¾	1 " 7 "
July 1–7,	210	70	101	1 " 10 "
7–14,	210	70	111½	1 " 8 "
14–22,	288	96	124¾	1 " 14 "
22–29,	252	84	140¾	2 " 4 "
29–Aug. 5,	228	76	147¾	1 " 0 "
Aug. 5–12,	180	60	156½	1 " 5 "
12–19,	252	84	170	1 " 15 "
19–26,	252	84	183½	1 " 15 "
26–Sept. 2,	258	86	188¼	0 " 11 "
Sept. 2–9,	231	77	202¼	2 " 0 "
9–16,	294	98	217¼	2 " 2⅜ "
16–22,	210	70	228¾	1 " 15 "

Total amount of feed consumed from May 21 to Sept. 22, 1884,—

221 lbs. Corn Meal, equal to dry matter, ... 189.57 lbs.
1,219 qts. Skim-milk, equal to dry matter, ... 255 45 lbs.

Total amount of dry matter, ... 454.02 lbs.

Live weight of animal at beginning of experiment, . . 44.75 lbs.
Live weight at time of killing, ... 228.75 lbs.
Live weight gained during experiment, ... 184. lbs.
Dressed weight at time of killing, ... 181.75 lbs.
Loss in weight by dressing, ... 47 lbs., or 20.5 per cent.
Dressed weight gained during experiment, . . . 146. lbs.

Cost of feed consumed during the experiment,—

221 lbs. Corn Meal, at 1.4 cents, ... $3 09
305 gals. Skim-milk, at 2 cents per gal., ... 6 10

$9 19

454 lbs. of dry matter fed, produced 184 lbs. of live weight, and 146 lbs. of dressed weight. 2.47 of dry matter yielded 1 lb. live weight; and 3.11 lbs. of dry matter yielded 1 lb. dressed weight.

Cost of feed for production of 1 lb. dressed pork, 6.3 cents.

[A.]

SKIM-MILK AND CORN MEAL — Continued.

II.

PERIODS.	FEED CONSUMED.		Weight of Animal (lbs.)	Daily Increase in Live Weight.
	Meal (ozs.)	Skim-milk (qts.)		
May 21-31,	100	58	54½	0 lbs. 12 ozs.
June 1-9,	132	54	77	1 " 11 "
9-17,	192	64	87¼	1 " 7 "
17-24,	152	50	97¾	1 " 8 "
24-30,	160	54	109	1 " 10 "
July 1-7,	210	70	121¼	1 " 12 "
7-14,	210	70	130¾	1 " 6 "
14-22,	288	96	141¾	1 " 9 "
22-29,	252	84	154½	1 " 13 "
29-Aug. 5,	228	76	162¾	1 " 3 "
Aug. 5-12,	180	60	167¼	0 " 10 "
12-19,	252	84	179	1 " 11 "
19-26,	252	84	190¾	1 " 11 "
26-Sept. 2,	258	86	193⅓	0 " 7 "
Sept. 2-9,	294	98	211½	2 " 8 "
9-16,	294	98	221¾	1 " 8 "
16-22,	210	70	230¼	1 " 7 "

Total amount of feed consumed from May 21 to Sept. 22,—

226½ lbs. Corn Meal, equal to dry matter,	197.92 lbs.
1,256 qts. Skim-milk, equal to dry matter,	263.21 lbs.
Total amount of dry matter,	461.13 lbs.

Live weight of animal at beginning of experiment,	54.50 lbs.
Live weight at time of killing,	230.25 lbs.
Live weight gained during experiment,	175.75 lbs.
Dressed weight at time of killing,	195. lbs.
Loss in weight by dressing,	35.25 lbs., or 15.3 per cent.
Dressed weight gained during experiment,	148.84 lbs.

Cost of feed consumed during the experiment,—

226½ lbs. Corn Meal, at 1.4 cents per lb.,	$3 17
314 gals. Skim-milk, at 2 cents per gal.,	6 28
	$9 45

461 lbs. of dry matter fed, produced 175.75 lbs. of live weight; and 148.84 lbs. of dressed weight. 263 lbs. of dry matter yielded 1 lb. live weight; and 3.08 lbs. dry matter yielded 1 lb. dressed weight.

Cost of feed for production of 1 lb. of pork, 6.4 cents.

[A]

SKIM MILK AND CORN MEAL — Concluded.

III.

PERIODS.	Feed Consumed. Meal (ozs.)	Feed Consumed. Skim-milk (qts.)	Weight of Animal (lbs.)	Daily Increase in Live Weight.
May 21–31,	100	58	50½	0 lbs. 15 ozs.
June 1–9,	132	54	74½	1 " 12 "
9–17,	192	64	85¾	1 " 10 "
17–24,	195	65	97¾	1 " 11 "
24–30,	195	65	114	2 " 5 "
July 1–7,	210	70	127¼	1 " 14 "
7–14,	252	84	145¼	2 " 9 "
14–22,	294	98	163	2 " 8 "
22–29,	294	98	181	2 " 9 "
29–Aug. 5,	294	98	200¾	2 " 13 "
Aug. 5–12,	294	98	214½	1 " 15 "
12–19,	294	98	236	3 " 1 "
19–26,	294	98	250½	2 " 1 "
26–Sept. 2,	300	100	257½	1 " 0 "
Sept. 2–9,	336	112	281¾	3 " 9 "
9–16,	336	112	293¾	1 " 12 "
16–22,	240	80	308½	2 " 7 "

Total amount of feed consumed from May 21 to Sept. 22,—

265¾ lbs. Corn Meal, equal to dry matter, ... 231.78 lbs.
1,452 qts. Skim-milk, equal to dry matter, ... 304.29 lbs.

Total amount of dry matter, ... 536.07 lbs.

Live weight at beginning of experiment, ... 50.50 lbs.
Live weight at time of killing, ... 308.50 lbs.
Live weight gained during experiment, ... 258. lbs.
Dressed weight at time of killing, ... 257.25 lbs.
Loss in weight by dressing, ... 51.25 lbs., or 16.64 per cent.
Dressed weight gained during experiment, ... 215.15 lbs.

Cost of feed consumed during experiment,—

265¾ lbs. Corn Meal, at 1.4 cents per lb., ... $3 72
363 gals. Skim-milk, at 2 cents per gal., ... 7 26

$10 98

536 lbs. of dry matter fed, produced 258 lbs. of live weight, and 215.15 lbs. dressed weight. 2.8 lbs. of dry matter yielded 1 lb. of live weight; and 2.5 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of pork, 5.11 cents.

[B]

BUTTERMILK AND CORN MEAL.

I.

PERIODS.	Feed Consumed. Meal (ozs.)	Feed Consumed. Buttermilk (qts.)	Weight of Animal (lbs.)	Daily Increase in Live Weight.
May 21–31,	100	58	$48\frac{1}{4}$	0 lbs. 11 ozs.
June 1–9,	132	54	66	1 " 6 "
9–17,	192	64	$77\frac{1}{2}$	1 " 7 "
17–24,	152	50	$87\frac{1}{2}$	1 " 7 "
24–30,	160	54	$98\frac{1}{2}$	1 " 9 "
July 1–7,	210	70	$107\frac{3}{4}$	1 " 5 "
7–14,	210	70	$120\frac{3}{4}$	1 " 14 "
14–22,	288	96	$131\frac{1}{2}$	1 " 8 "
22–29,	252	84	$143\frac{3}{4}$	1 " 12 "
29–Aug. 5,	192	68	$153\frac{3}{4}$	1 " 7 "
Aug. 5–12,	168	56	$160\frac{3}{4}$	1 " 0 "
12–19,	252	84	$172\frac{1}{2}$	1 " 11 "
19–26,	252	84	$183\frac{1}{4}$	1 " 8 "
26–Sept. 2,	258	86	185	0 " 4 "
Sept. 2–9,	294	98	$206\frac{1}{4}$	3 " 0 "
9–16,	294	98	$219\frac{1}{4}$	1 " 14 "
16–22,	294	70	$230\frac{1}{2}$	1 " 14 "

Total amount of feed consumed from May 21 to Sept. 22,—

226 lbs. Corn Meal, equal to dry matter, ...	197.48 lbs.
1,244 qts. Buttermilk, equal to dry matter, ...	190.33 lbs.
Total amount of dry matter, ...	387.81 lbs.

Live weight of animal at beginning of experiment, . .	48.25 lbs.
Live weight at time of killing, ...	230.50 lbs.
Live weight gained during the experiment, ...	182.25 lbs.
Dressed weight at time of killing, ...	190.75 lbs.
Loss in weight by dressing, ...	39.75 lbs., or 17.3 per cent
Dressed weight gained during experiment, . .	150.85 lbs.

Cost of fodder consumed during experiment,—

226 lbs. Corn Meal, at 1.4 cents per lb., ...	\$3 16
311 gals. Buttermilk, at 1.37 cents per gal., ...	4 26
	\$7 42

387.8 lbs. of dry matter fed, produced 182.25 lbs. of live weight, and 150.85 lbs. of dressed weight. 2.12 lbs. of dry matter yielded 1 lb. of live weight; and 2.57 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of pork, 4.92 cents.

[B.]

BUTTERMILK AND CORN MEAL — Continued.

II.

PERIODS.	Feed Consumed.		Weight of Animal (lbs.)	Daily Increase in Live Weight.
	Meal (ozs.)	Buttermilk (qts.)		
May 21–31,	100	58	45½	0 lbs. 12 ozs.
June 1–9,	132	54	67½	1 " 7 "
9–17,	192	64	79½	1 " 11 "
17–24,	152	50	89¾	1 " 6 "
24–30,	160	54	100	1 " 7 "
July 1–7,	210	70	111	1 " 9 "
7–14,	210	70	123¾	1 " 3 "
14–22,	288	96	135½	1 " 11 "
22–29,	252	84	147¼	1 " 11 "
29–Aug. 5,	192	68	158	1 " 8 "
Aug. 5–12,	168	56	163¾	0 " 13 "
12–19,	252	84	177	1 " 14 "
19–26,	252	84	189½	1 " 12 "
26–Sept. 2,	258	86	189	0 " 1⅐ "
Sept. 2–9,	294	98	211¾	3 " 4 "
9–16,	294	98	226¼	2 " 1 "
16–22,	210	70	238	1 " 15 "

Total amount of feed consumed from May 21 to Sept. 22, —

226 lbs. Corn Meal, equal to dry matter,	197.48 lbs.
1,244 qts. Buttermilk, equal to dry matter,	190.33 lbs.
Total amount of dry matter,	387.81 lbs.

Live weight of animal at beginning of experiment,	45.50 lbs.
Live weight at time of killing,	238. lbs.
Live weight gained during experiment,	192.50 lbs.
Dressed weight at time of killing,	199.25 lbs.
Loss in weight by dressing,	38.75 lbs., or 16.3 per cent.
Dressed weight gained during experiment,	161.2 lbs.

Cost of feed consumed during the experiment, —

226 lbs. Corn Meal, at 1.4 cents per lb.,	$3 16
311 gals. Buttermilk, at 1.37 cents per gal.,	4 26
	$7 42

387.8 lbs. of dry matter fed, produced 192.50 lbs live weight, and 161.2 lbs. dressed weight. 2.01 lbs. dry matter yielded 1 lb. of live weight; and 2.4 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb of pork, 4.64 cents.

[B.]

BUTTERMILK AND CORN MEAL — Concluded.

III.

PERIODS.	Feed Consumed. Meal (ozs.)	Feed Consumed. Buttermilk (qts.)	Weight of Animal (lbs.)	Daily Increase in Live Weight.
May 21–31,	100	58	49	0 lbs. 11 ozs.
June 1–9,	132	54	72	1 " 10 "
9–17,	192	64	85¼	1 " 14 "
17–24,	195	65	98	1 " 13 "
24–30,	195	65	109¼	1 " 10 "
July 1–7,	210	70	121¾	1 " 12 "
7–14,	252	84	133¼	1 " 10 "
14–22,	294	98	151½	2 " 10 "
22–29,	294	98	167	2 " 3 "
29–Aug. 5,	294	98	186¼	2 " 12 "
Aug. 5–12,	294	98	199¾	1 " 15 "
12–19,	294	98	218½	2 " 11 "
19–26,	294	98	227¾	1 " 5 "
26–Sept. 2,	300	100	233½	0 " 13 "
Sept. 2–9,	336	112	259	3 " 11 "
9–16,	336	112	281	3 " 2 "
16–22,	240	80	293¼	2 " 1 "

Total amount of feed consumed from May 21 to Sept. 22,—

265¾ lbs. Corn Meal, equal to dry matter,	232.21 lbs.
1,452 qts. Buttermilk, equal to dry matter,	222.16 lbs.
Total amount of dry matter,	454.37 lbs.

Live weight of animal at beginning of experiment,	49 lbs.
Live weight at time of killing,	293¼ lbs.
Live weight gained during experiment,	244¼ lbs.
Dressed weight at time of killing,	243 lbs.
Loss in weight by dressing,	50 lbs., or 17 per cent.
Dressed weight gained during experiment,	202.3 lbs.

Cost of feed consumed during the experiment,—

265¾ lbs. Corn Meal at 1.4 cents per lb.,	$3 72
363 gals. Buttermilk, at 1.37 cents per gal.,	4 98
	$8 70

454.37 lbs. of dry matter fed, produced 244¼ lbs. of live weight, and 202.3 lbs. dressed weight. 1.86 lbs. of dry matter yielded 1 lb. of live weight; and 2.23 lbs. of dry matter yielded 1 lb. of dressed weight.

Cost of feed for production of 1 lb. of pork, 4.3 cents.

Summary of Results of Experiments.

A.—Pigs Fed with Skim-milk and Corn Meal.

	Corn Meal, in Pounds.	Skim-milk, in Gallons.	Live Weight gained during Experiment.	Dressed Wt. gained during Experiment.
I., ...	221	305	184	146
II., ...	226½	314	175¾	148⅘
III., ...	265¾	363	258	215⅕
	713¼	982	617¾	510

B.—Pigs Fed with Creamery Buttermilk and Corn Meal.

	Corn Meal, in Pounds.	Buttermilk, in Gallons.	Live Weight gained during Experiment.	Dressed Wt. gained during Experiment.
I., ...	226	311	182¼	150 9/10
II., ...	226	311	192½	161 2/10
III., ...	265¾	363	244¼	202 8/10
	717¾	985	619	514 4/10

Total Cost of Feed consumed during the Experiment.

A.	713¼ lbs. Corn Meal, ...	$9 98
	982 gals. Skim-milk, ...	19 64
		$29 62
B.	717¾ lbs. Corn Meal, ...	$10 04
	985 gals. Buttermilk, ...	13 50
		$23 54

Cost of Feed per Pound of Dressed Pork produced.

A.	Skim-milk and Meal, ...	5.8 cents.
B.	Buttermilk and Meal, ...	4.6 cents.

The difference in cost is approximately equal to the difference in cost of the buttermilk and skim-milk.

Analyses of Milk used in the Experiment.

SKIM-MILK.

[From the College and Experiment Station Farms.]

	I.	II.	III.	Mean.
Water, ...	90.20	90.42	90.64	90.42
Solids, ...	9.80	9.58	9.36	9.58
Fat (in solids), . .	.68	.32	.18	.39
Casein (nitrogenous matter, in solids), . .	–	3.23	–	3.23

Nutritive Ratio, 1 : 2.15.

These analyses represent the kind of skim-milk fed during the previously described feeding experiment. One quart weighed 35 ounces and contained 3.35 ounces of solid (dried) matter.

BUTTERMILK.

[From the Amherst Co-operative Creamery Association.]

	I.	II.	III.	Mean.
Water, ...	92.79	92.76	93.17	90.90
Solids, ...	7.21	7.25	6.83	7.09
Fat (in solids), . .	.20	.22	–	.21
Casein (nitrogenous matter, in solids), . .	–	2.90	–	2.90

Nutritive Ratio, 1 : 1.63.

These analyses were made at the same date when the skim-milk tests were carried out, and represent, as far as practicable, the quality of buttermilk fed during the above-described feeding trial.

One quart of buttermilk weighed 34 ounces and contained 2.41 ounces of solid matter (dried).

CORN MEAL.

[92.34 per cent. passed through mesh 144 to the square inch.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.62	252.4	-	-	
Dry Matter,	87.38	1,747.6	-	-	
	100.00	2,000.0	-	-	
Analysis of Dry Matter.					
Crude Ash,	1.56	31.2	-	-	
" Cellulose,	2.65	53.0	18.06	34	1 : 8.68
" Fat,	4.27	85.4	64.90	76	
" Protein (Nitrogenous Matter),	11.43	228.6	194.31	85	
Non-nitrogenous Extract Matter,	80.09	1,601.8	1,505.69	94	
	100.00	2,000.0	1,782.96	-	

This article represents the average composition of the corn meal fed in connection with skim-milk and buttermilk in the feeding experiments with pigs, described in the previous pages.

WHEAT BRAN.

[From John L. Holley, South Amherst, Mass.; 13.71 per cent. passed through mesh 144 to the square inch.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.48	209.6	-	-	
Dry Matter,	89.52	1,790.4	-	-	
	100.00	2,000.0	-	-	
Analysis of Dry Matter.					
Crude Ash,	6.98	139.6			
" Cellulose,	10.20	204.0	40.80	20	1 : 3.25
" Fat,	4.77	95.4	76.32	80	
" Protein (Nitrogenous Matter),	20.24	404.8	356.22	88	
Non-nitrogenous Extract Matter,	57.81	1,156.2	924.96	80	
	100.00	2,000.0	1,398.30	-	

The wheat bran of the previous table sold at $23 at the mill. This quality of wheat bran was fed during the gluten-meal feeding experiment with milch cows.

TIMOTHY HAY.

[From the grounds of the Experiment Station, June 20, 1884.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	10.55	211.0	–	–	1 : 10.6
Dry Matter, ...	89.45	1,789.0	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	4.69	93.8	–	–	
" Cellulose, . . .	29.21	584.2	338.84	58	
" Fat, ...	2.65	53.0	24.38	46	
" Protein (Nitrogenous Matter), . . .	9.02	180.4	102.83	57	
Non-nitrogenous Extract Matter, ...	54.43	1,088.6	685.82	63	
	100.00	2,000.0	1,151.87	–	

The grass was cut at the close of the blooming period, and the hay is a fair article of its kind. It served during the gluten-meal feeding experiment with milch cows.

FIELD EXPERIMENTS.

The Experiment Station has entered already, in its first year of existence, upon a systematic course of experiments to assist in determining the influence, mode of cultivation, of system of manuring, and of stage of growth, on the comparative feeding value of some of our prominent farm crops.

The results thus far published, although essentially of local interest, deserve more than a passing notice, on account of the scarcity of examinations of a similar character of forage crops raised under quite common circumstances within the limits of the State.

The significance of the various analytical results will become more apparent as the work progresses.

As the character of our soil, and its particular state of fertility, ought to be better known before a more detailed discussion of the connection between soil, season and composition of the crop can be considered profitable, a mere record of the progress of the analytical work is all that can be consistently published at the present stage of the investigation.

Aside from the trials with some of our standard forage crops, there have been also inaugurated experiments with the cultivation of reputed forage crops of other localities and countries, to test their adaptability to our soil and climate. The successful introduction of a greater variety of valuable fodder crops, promises to furnish a wider range of fodder-substances, as far as their relative, as well as absolute, nutritive value is concerned, a circumstance not less acceptable to our agricultural industry than it has proved elsewhere. The best interests of the dairy business call for an efficient protection against a serious periodical influence of drought on the yield of meadows and pastures. The cultivation of fodder crops, growing upon different kinds of soil,

and maturing at different periods of the season, have proved of valuable assistance in that direction. Some of the results of our trials with cow pea, serradella, vetch, common lucerne (alfava), sand lucerne, horse bean, lupine and pearl millet, will be reported within a few subsequent pages. This record of our past work in this direction makes no other claim than to more prominently introduce the subject.

1. Fodder Corn (without Manure), upon Underdrained Plats.

[See Sketch A, p. 408.]

In the first annual report of the station has been described by Prof. M. Miles, the underdraining of a piece of land, one and one-tenth of an acre in size, subdivided into eleven plats.

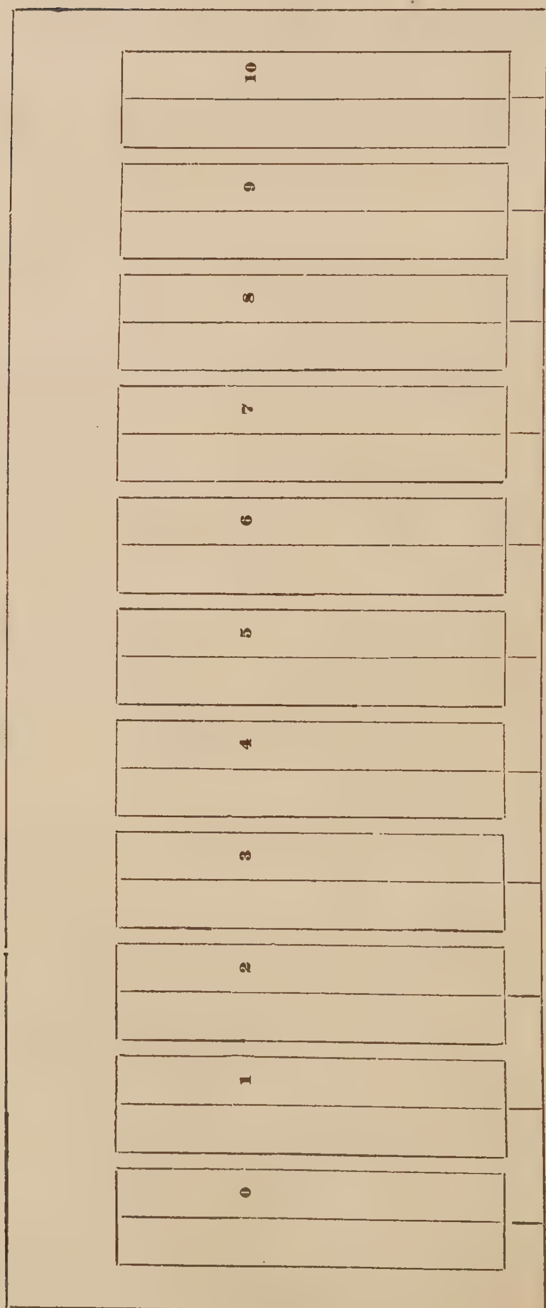
The field was designed to serve for an examination into the action of various manurial substances on the growth of corn, and the influence on the character of the drainage water discharged from the drains, under a different treatment of the soil.

The chemical analysis of the first water running from the pipes of the different plats after a rainfall May 22, 1883, has been reported in the above-mentioned connection; and also the character of the soil, cultivation of the cornfield, and the final yield of corn and of stalks.

No manure was applied that year. It was desirable, in the interest of the particular experiments hereafter to be carried on upon that field, that its latent resources of plant-food should be, as far as practicable, exhausted, with reference to the requirements for the production of Indian Corn.

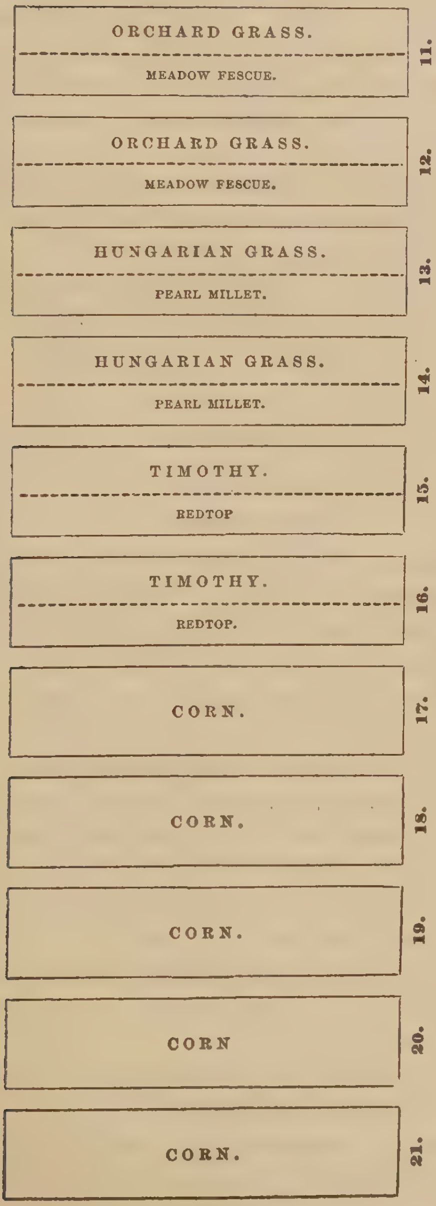
During the past season the field has been planted again with corn, for corn fodder, without the application of manure of any description. The soil received a thorough mechanical preparation by ploughing and harrowing, and the corn (variety : Clark) was planted in drills, two and one-half feet apart, at the rate of two bushels per acre, on the 24th of May. The entire area was ploughed lengthwise, and thus across the plats. The crop was kept clean from weeds by timely use of the cultivator. The plants started well in the spring, yet began soon to fall behind, in general appearance, other fodder cornfields in the vicinity, upon fertilized lands.

SKETCH "A."



Corn Plats with Drainage System. Scale, 4 rods to 1 inch.

SKETCH "B."



Corn and Grass Plats. Scale, 4 rods to 1 inch.

At the beginning of blooming it turned gradually yellow, failed to produce grain-bearing cobs, and suffered, toward the end of the month of August, seriously, from smut.

The corn was cut on the first of September and stacked in the field for drying. The entire yield of corn fodder from this piece of land, one and one-tenth of an acre in size, amounted to 5,040 pounds, with a moisture of thirty per cent.

The soil is evidently in suitable condition for studying the special effects of various forms and kinds of plant food on the corn during the coming season.

It is worthy to notice the fact, that vigorous corn crops, growing upon fertilized fields, alongside, upon a similar soil, showed no smut at the same period of growth.

2. Influence of Fertilizers on the Quantity and Quality of Fodder Crops.

[See Sketch B, p. 409.]

The land selected for the experiment had been used, for several years previous, for the production of hay. At the beginning of the season of 1883, it had been ploughed and planted with corn, without the addition of any fertilizer. The soil consisted of a good sandy loam, and was, in consequence of its previous treatment, in a suitably impoverished condition to respond to the application of fertilizers.

The entire field, consisting of one and one-tenth of an acre, was sub-divided into plats, each one-tenth of an acre in size. Every alternate plat was fertilized at the rate of six hundred pounds of ground, rendered bones, and two hundred pounds of muriate of potash, per acre. The fertilizer was applied a few days before seeding, and slightly harrowed under.

The fertilized plats (Nos. 11, 13, 15, 17, 19 and 21) were seeded May 13; and the unfertilized plats (Nos. 12, 14, 16, 18 and 20) May 17, 1884.

The experiment comprised four standard grasses, *i. e.*, Orchard grass *(Dactylis glomerata)*, Meadow fescue (*Frestuca pratensis*), Timothy *(Phleum pratensis)*, and Redtop *(Agrostis vulgaris)*, besides two millets, — Hungarian

grass *(Panicum Germanicum)* and Pearl millet,—and one variety of corn (Clark). In the case of the grasses and millets, each plat was again sub-divided in two, and each one-half seeded down with one distinct kind of grass seed as follows:—

Plat I. (fertilized), . . .	Orchard Grass (north side). Meadow Fescue (south side).
Plat II. (unfertilized), . .	Orchard Grass (north side). Meadow Fescue (south side).
Plat III. (fertilized), . .	Hungarian Grass (north side). Pearl Millet (south side).
Plat IV. (unfertilized), . .	Hungarian Grass (north side). Pearl Millet (south side).
Plat V. (fertilized), . . .	Timothy (north side). Redtop (south side).
Plat VI. (unfertilized), . .	Timothy (north side). Redtop (south side).
Plat VII. (fertilized), . . .	Corn (Clark).
Plat VIII. (unfertilized), . .	Corn (Clark).
Plat IX. (fertilized), . . .	Corn (Clark).
Plat X. (unfertilized), . .	Corn (Clark).

The corn was planted the 24th of May, in drills two and one-half feet apart, at the rate of two bushels per acre. A severe frost on the night of from 29th to 30th of May, injured the millets seriously, and the remaining crops slightly.

The corn was kept clean by the use of a cultivator. The grasses were repeatedly cut, for the mere purpose of killing the weeds off. Their examination, regarding quality, as well as quantity, is, for obvious reason, deferred to the second year of their growth.

Results of Experiments with Corn.

Fertilized Plats, $\frac{1}{10}$ of an acre each.	Plat VII.	4,340 lbs.	Total yield, 7,436 lbs.
	Plat IX.	3,096 lbs.	
Unfertilized Plats, $\frac{1}{10}$ of an acre each.	Plat VIII.	2,460 lbs.	Total yield, 5,016 lbs.
	Plat X.	2,556 lbs.	

Yield of Fertilized Plats, per acre, ...	37,180 lbs.
Yield of Unfertilized Plats, per acre, ...	25,080 lbs.
Difference in yield, ...	12,100 lbs.

The entire crop of corn fodder was cut September 1. The corn fodders growing upon the fertilized and unfertilized plats, differed widely from each other, in their general appearance during the second half of the season. The growth upon the former retained its healthy and vigorous appearance to the time of cutting, whilst that raised upon the unfertilized plats turned gradually yellow, and suffered, at the close of the season, seriously, from smut.

The crop gathered from the fertilized plats was converted into ensilage; and that from the unfertilized plats was stacked in the field for dry corn fodder.

Analysis of Green Fodder Corn.

		Plat VII. (Fertilized.)	Plat VIII. (Unfertilized.)
1884.			
July 25, at the beginning of Blooming.	Moisture at 100° C.,	87.62	85.15
	Dry Vegetable Matter,	12.38	14.85
Sept. 1, Kernels in Milk.	Moisture at 100° C.,	72.27	78.77
	Dry Vegetable Matter,	27.73	21.23

Judging from these results it appears that the plants upon the unfertilized plats advanced more rapidly towards maturity than those upon the fertilized fields, yet fell considerably behind in the production of vegetable matter at the close of the season; for one hundred parts of the former contained only 21.23 per cent. dry matter, while the latter showed a yield of 27.73 per cent. of dry matter, a difference of 6.5 per cent. One hundred pounds of the fodder corn, grown upon the unfertilized plats, contained at the time of harvesting (kernels in milk), 6.5 pounds less of vegetable matter than the one raised upon the fertilized plats, a difference equal to from twenty to twenty-five per cent. of vegetable matter in favor of the fertilized fodder corn. Adding to this advantage the difference in the total weight of corn fodder at the time of harvesting, an amount equal to thirty-three per cent. of the entire growth, it is but proper to state that the total effect of the fertilizer on the crop should be rated in our case with an increase equal to from forty-eight to fifty per cent. of the entire crop.

Composition of Dry Vegetable Matter in Corn Fodder (fertilized).

One hundred parts contained :—

Crude ash,	3.16 parts.
" cellulose,	24.32 "
" fat,	2.89 "
" protein,	9.64 "
Non-nitrogenous extract matter,	59.99 "

3. Experiments with Potatoes.

Var.: Beauty of Hebron.

These experiments were instituted for the purpose of studying the effects of muriate of potash and of sulphate of potash on the yield of potatoes as far as quantity and quality are concerned. The conclusions drawn in this direction from previous investigations are somewhat contradictory. Some practical observers state that the sulphate of potash produces a more mealy tuber, and thus a more valuable article for family use, than the muriate of potash, while others deny that claim.

A mealy potato contains usually a liberal percentage of starch and a low one of nitrogenous matter. As the degree of maturity of a plant or part of a plant controls, to a large extent, the relative proportions of its proximate organic constituents, as starch, nitrogenous matter, etc., it seems not without interest to ascertain whether the noted difference of opinion regarding the specific action of sulphate and muriate of potash might not find a more correct explanation in the assumption that a more or less advanced state of maturity of the various crops of potatoes tested on previous occasions may account for the contradictory conclusions on record.

Three plats, each one-fifth of an acre in size, were chosen for the experiment. The land had been years in grass and contained quite a number of old apple trees. The majority of the latter were removed, and the turf thoroughly broken up before manuring.

Plat one (west end) received one hundred and twenty pounds of ground rendered bones and thirty pounds of muriate of potash (equal to from twenty-six to twenty-seven pounds of phosphoric acid, four to four and one-half pounds of nitrogen, and fifteen to sixteen pounds of potassium oxide).

Plat two received no manure of any kind.

Plat three (east end) received one hundred and twenty pounds of ground rendered bones, fifty-eight pounds of double

sulphate of potash and magnesia (equal to from twenty-six to twenty-seven pounds of phosphoric acid, four to four and one-half pounds of nitrogen, fifteen to sixteen pounds of potassium oxide, and five to six pounds of magnesium oxide).

The fertilizers were applied broadcast and harrowed under before planting. The potatoes were planted in rows, three feet apart and fourteen inches distant in the drills, during the first week in May, 1884. The crop was kept clean from weeds by a timely use of a cultivator.

As a mere incidental feature of the experiment, one-half of each plat was planted with medium-sized whole potatoes, the other one with half potatoes.

The vines produced by whole potatoes showed a more vigorous growth, during the main part of the season, than those by part of a potato. The entire field looked promising until towards the middle of August, when the appearance of the blight prematurely terminated the life of the stems and leaves.

The crop was harvested on the 9th and 10th of September, with the following results: —

PLAT I.

SEED POTATOES.	Fertilizer applied.	Yield of Potatoes upon One-Fifth of an Acre of Land, in Pounds.		
		Large.	*Small.*	*Total.*
Whole Potato, .	120 lbs. ground rendered bones and 30 lbs. muriate of potash.	1,085	460	1,545
One-half a Potato,		1,140	335	1,485

PLAT II.

		Large.	*Small.*	*Total.*
Whole Potato, .	Not Fertilized.	830	280	1,110
One-half a Potato,		850	250	1,100

PLAT III.

		Large.	*Small.*	*Total.*
Whole Potato, .	120 lbs. ground rendered bones and 58 lbs. of double sulphate of potash and magnesia.	1,120	342	1,462
One-half a Potato,		930	105	1,035

Analyses of Potatoes.

One hundred weight parts of air-dried fresh potatoes contained:

	From Plat I.	From Plat II.	From Plat III.
Dry Vegetable Matter, . . .	19.39	23.30	21.52
Water, ...	80.61	76.70	78.48
	100.00	100.00	100.00

A well matured potato contains on an average, approximately, twenty-five per cent. of solid matter. The unmanured potatoes were evidently more advanced in growth, whilst those manured with muriate of potash were least advanced in that direction.

The latter, on the other hand, had the smoothest skins, and were almost entirely free from scab, which disfigured seriously those from Plats II. and III.

As a first trial, under unfavorable circumstances, does not entitle to a critical discussion of results beyond a mere statement of the facts as above recorded, it is proposed to repeat the experiment during the coming season.

4. Experiments Concerning the Adaptation of some Reputed Forage Crops, from other Localities, to our Climate and Soil.

The desirability of introducing into our farm management a greater variety of fodder plants, is generally conceded. In choosing plants for that purpose, it seemed advisable to select crops which would advantageously supplement our leading fodder crop (aside from the products of pasture and meadows), the fodder corn and corn stover, as green fodder as well as in the form of hay. Taking this view of the question, the great and valuable family of *Leguminosæ* suggested itself, as a class of plants in a particular degree qualified for that purpose, not only, but, in the interest of a wider range, for the introduction of economical systems of rotation under various conditions of soil and different requirements of markets.

The results thus far obtained upon the fields of the station, although still limited, are not without considerable encouragement. A short description of the work carried on in that direction is given in a few subsequent pages. The experiment with cow peas was carried on during the season of 1883; those with vetch and serradella extended over two seasons, 1883 and 1884; and those with lucerne and horse bean began with the season of 1884.

SKETCH "C."

Forage Plats (1884.) Scale, 80 feet to 1 inch.

Our first year's observations are mainly directed towards their behavior with regard to our climate and soil. The economical questions involved in their cultivation will receive, whenever desirable, during coming years, special attention.

None of the crops treated under the above heading suffered to any serious extent from the severe frost on the 29th of May.

The results of the experiments with lupine and two varieties of lucerne are not stated in this report, as the examination of the products obtained is not yet finished.

The results in the field were quite encouraging.

[A.] COW PEA.

DOLICHOS (SINENSIS?); VARIETY, CLAY.

[From Experimental Plats of Station; collected Aug. 1, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.30	186.00	–	–	1 : 4.75
Dry Matter,	90.70	–	–	–	
	100.00		–	–	
Analysis of Dry Matter.					
Crude Ash,	9.53	190.60	–	–	
" Cellulose,	23.58	471.60	221.65	47	
" Fat,	3.81	76.20	44.96	59	
" Protein,	17.02	340.40	204.24	60	
Non-nitrogenous Extract Matter,	46.06	921.20	635.63	69	
	100.00	2,000.00	1,106.48	–	

The seeds for these experiments were obtained through the kindness of Dr. Dabney, director of the State Experiment Station of North Carolina. The rates of digestibility of the various constituents of the hay of the cow pea, above stated, are those of clover hay, a fodder substance of a similar character. The "Clay" variety of the cow pea is considered the best of the many varieties raised in the Southern States. The merits of this plant are described by a farmer of North Carolina in the following words: —

"It has no tendrils but twines like beans, or runs upon its own foliage. It is of a rapid growth, making, in three months, on ordinary land, an

almost impenetrable mass of foliage, two feet high, and so very dense that it destroys all other vegetation, even the thistle, ragweed, and other noxious plants. When well cured these vines are simply invaluable foi hay, and worth, as ascertained by actual experiments, 33 to 50 per cent. more than timothy. The only difficulty in making them the leading crop for hay is that it takes three days to cure them. Cattle and horses prefer such hay to the best of herds-grass, and even to corn. Pea vines are the best fertilizer we can use, decomposing very rapidly. I have frequently cut off the vines before they began to run (July 1), and by August the roots would throw out new vines two feet long. The seed sold in May for 75 cents per bushel."

The experimental plats were seeded down towards the latter part of May, and produced a handsome, dense foliaceous growth, about eighteen inches high, at the beginning of August when the samples for analysis were collected.

The early frost in September injured the crop. The plant apparently deserves the importance claimed for it in the above stated report. Its cultivation has proved a success in New Jersey. The only objection which might be raised against its introduction consists in the circumstance that matured seeds cannot be relied on in our section of the country.

As a green fodder it compares well with clover, and most likely would produce a valuable ensilage.

COW PEA.

VARIETY: WHIPPOORWILL.

[From Experimental Plats of Station; collected Aug. 1, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.65	193.00	–	–	1 : 4.74
Dry Matter,	90.35	1,807.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	10.46	209.20	–	–	
" Cellulose,	22.36	447.20	210.18	47	
" Fat,	3.87	77.40	45.67	59	
" Protein (Nitrogenous Matter,	16.95	339.00	203.40	60	
Non-nitrogenous Extract Matter,	46.36	927.20	639.77	69	
	100.00	2,000.00	1,099.02	–	

The variety of the preceding table is described as making but little vine, and is considered less valuable than the "Clay" variety. It made a dense foliaceous growth, fully equal to the latter in size. Neither of them produced seeds.

COW PEA.

VARIETY: WHIPPOORWILL.

[Raised on Plats of Station, as Mixed Crop, with Oats. Collected Aug. 1, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.75	195.00	–	–	1 : 4.95
Dry Matter,	90.25	1,805.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.87	157.40	–	–	
" Cellulose,	19.06	381.20	179.16	47	
" Fat,	4.49	89.80	52.98	59	
" Protein (Nitrogenous Matter),	17.17	343.40	206.04	60	
Non-nitrogenous Extract Matter,	51.41	1,028.20	709.46	69	
	100.00	2,000.00	1,147.64	–	

The analysis was made from the pea vines raised with the oats; the analysis of the latter has been reported in Bulletin 5 (No. 102). This course of separate analysis was adopted on account of the uneven distribution of both plants. The mixed crop was, on the first of August, in excellent condition for green fodder or hay. An experiment with rye failed, on account of a bad quality of rye. Assuming the mixed crop of peas and oats to consist of three times as much oats as peas, the nutritive ratio of the mixture would be 1 : 12. In case of two parts of oats and one of cow peas, the ratio would 1 : 10, and in case of even quantities of both plants, the ratio would be 1 : 8.7. Raised in connection with rye the nutritive value of the mixed crop would be still higher. Within three months' time, a fodder can be raised *fully equal, if not decidedly superior in nutritive value, to our best English grasses.*

[B.] VETCH.

(*Vicia sativa; variety, Augustifolia.*)

The vetch has received already considerable attention in various sections of our country; reports thus far speak with much satisfaction of the results. The plant resembles, in many respects, the common garden pea; there are early and late varieties in cultivation. Its period of vegetation is from 18 to 22 weeks, and the time for seeding corresponds with that of the pea. The common vetch is a hardier plant than the latter, and grows well upon an inferior soil. Its reputation as a valuable green fodder, either single or when grown in common with rye, oats or barley, is well established.

The lands were seeded down broadcast, in our experiment during the past season, on the 15th of May. The first crop was secured July 2, at the beginning of blooming. One hundred parts of the plant in that state of growth contained:—

Moisture at 100° C., ...	78.20 per cent.
Dry Matter (vegetable), ...	21.80 " "
	100.00

VETCH.

(VICIA SATIVA; VARIETY, AUGUSTIFOLIA.)

[I. Collected from Experimental Plats, Aug. 15, 1883, in bloom.]

I.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	8.35	167.00	-	-	1 : 4.02
Dry Matter, ...	91.65	1,833.00	-	-	
	100.00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash, ...	7.97	159.40	-	-	
" Cellulose, . . .	30.68	613.60	331.34	54	
" Fat, ...	2.30	46.00	27.60	60	
" Protein (Nitrogenous Matter), . . .	15.76	315.20	239.55	76	
Non-nitrogenous Extract Matter, ...	43.29	865.80	562.77	65	
	100.00	2,000.00	1,161 26	-	

VETCH.

[II. Collected from Experimental Plats, Sept. 3, 1883, when fully matured.]

II.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.45	189.00	–	–	1 : 4.09
Dry Matter,	90.55	1,811.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	8.50	170.00	–	–	
" Cellulose,	30.05	601.00	270.45	45	
" Fat,	2.69	53.80	32.28	60	
" Protein (Nitrogenous Matter),	14.42	288.40	204.76	71	
Non-nitrogenous Extract Matter,	44.34	886.80	487.74	55	
	100.00	2,000.00	995.23	–	

[C.] Serradella.

(*Ornithopus sativus. Brot.*)

The serradella, like the vetch, is an annual leguminous plant, which found its way from Portugal into central Europe some fifty years ago. It grows from one foot to one foot and one-half high, and prefers a moist, deep, sandy soil. Time of seeding and mode of cultivation correspond with those customary in the cultivation of peas. The growth of the plant is slow until the time of blooming, when it rapidly increases in size and nutritive constituents. The close of the blooming period, at the end of August, is the best time for cutting the crop. Leading agriculturists speak very highly of this fodder plant. The field seeded down broadcast on the 15th of May, 1884, produced a first crop, blooming on the 22d of July. The plants, at that period of their growth, contained in one hundred parts: —

Moisture at 100° C.,	78.66 parts
Vegetable Matter (dried),	21.34 "
	100.00

SERRADELLA.

(ORNITHOPUS SATIVUS. BROT.)

[I. Obtained from Plats of the Station, when blooming, Aug. 14, 1883.]

I.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	7.20	144.00	-	-	1 : 4.72
Dry Matter,	92.80	1,856.00	-	-	
	100 00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash,	5.87	117.40	-	-	
" Cellulose,	24.37	487.40	-	-	
" Fat,	2.37	47.40	28.44	60	
" Protein (Nitrogenous Matter),	17.85	357.00	224.91	63	
Non-nitrogenous Extract Matter,	49.54	990.80	990.80	100	
	100.00	2,000.00	1,244.15	-	

SERRADELLA.

[II. From Plats of Station, collected Sept. 3, 1883, when fully matured.]

II.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.70	174.00	-	-	1 : 5.47
Dry Matter,	91 30	1,826.00	-	-	
	100.00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash,	6.46	129.20	-	-	
" Cellulose,	25.14	502.80	236.32	47	
" Fat,	2.91	58.20	29.10	50	
" Protein (Nitrogenous Matter),	15.26	305.20	183.12	60	
Non-nitrogenous Extract Matter,	50.23	1,004.60	693.17	69	
	100.00	2,000.00	1,141.71	-	

The two foregoing stated analyses of Serradella in different stages of growth (1883), confirm the general observation that the leguminous plants, like the clover, vetch, beans, peas, etc., as a rule, furnish the most nutritious food at the time of blooming.

[D.] Horse Bean.

(*Vicia Faba. L.*)

The plant came from Southern Russia, and was cultivated at an early date, already, in Southern Europe. There are several varieties, small and large, in use. The latter is at present quite frequently raised in the gardens of England, France and Germany, for family use; whilst the smaller variety, like the one on trial, is cultivated throughout Europe for fodder.

The ground beans are considered a valuable food for horses, milch cows and swine. The softer parts of the straw form a valuable addition to the daily diet of the majority of the farm stock. Beans and straw are highly nitrogenous. The horse bean is considered one of the most reliable leguminous plants upon a heavy loam or dry clayish soil, in a temperate and moderately moist climate. Raised with vetch and peas, it serves a twofold purpose, *i. e.*, to uphold the vines of these plants, and to increase their feeding value as green fodder. They are planted quite early, in rows from two to two and one-half feet distant, and two inches apart in the drills. The plant reaches a height of from two to three feet at the beginning of blooming, and has a thick, hollow, somewhat angular, juicy stem, with succulent leaves, which at the time of maturing turn black.

The field upon the grounds of the station was seeded down the 15th of May, 1884, in rows two and one-half feet apart. It was kept clear from weeds by means of a cultivator. The crop was very satisfactory. It began blooming in the first week of July. The plants at that time contained in one hundred parts: —

Moisture at 100° C., ...	87.72 parts.
Vegetable Matter (dried), ...	12.28 "
	100.00

At the time of harvesting, when the pods were fully developed, one hundred parts of the entire plant contained : —

Moisture at 100° C.,	73.14 parts.
Vegetable Matter,	26.86 "
	100.00

The crop was cut several inches above ground, put into small shocks, and kept upon the field until September 15, when it was dry enough for storing in the barn. The total crop at that time weighed 405 lbs. ; it lost 4.5 per cent. more moisture from that date to the 17th of October, when, by thrashing, the beans were separated from the straw.

HORSE BEAN.

(VICEA FABA.)

[Collected from the plats of the Station when harvested.]

Moisture at 100° C.,	73.14 parts.
Dry Vegetable Matter,	26.86 "

	STRAW.	BEAN.
Moisture at 100 C.,	9.15	10.28
Dry Matter,	90.85	89.72

Analysis of Dry Matter.

Crude Ash,	9.59 per cent.	4.27 per cent.
" Cellulose,	41.44 "	8.11 "
" Fat,	1.51 "	1.11 "
" Protein (Nitrogenous Matter),	9.69 "	30.03 "
Non-nitrogenous Extract Matter,	37.77 "	56.48 "
Ratio of Beans to Straw,		46 : 54

OBSERVATIONS REGARDING THE RATES OF DIGESTIBILITY OF BOTH BEANS AND STRAW WITH EMPTY PODS.

I. HORSE BEAN.

RESULTS OBTAINED BY FEEDING IT TO CATTLE.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . . .	10.28	205.60	–	–	1 : 2.24.
Dry Matter, ...	89 72	1,794.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	4 27	85.40	–	–	
" Cellulose, . . .	8 11	162.20	102.19	63	
" Fat, ...	1.11	22.20	21.53	97	
" Protein (Nitrogenous Matter), . . .	30.03	600.60	540.54	90	
Non-nitrogenous Extract Matter, ...	56.48	1,129.60	1,061.82	94	
	100.00	2,000.00	1,726.08	–	

II. BEAN STRAW AND PODS.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Analysis of Dry Matter.					
Crude Ash, ...	9.59	191.80	–	–	1 : 8.55
" Cellulose, . . .	41.44	828.80	298.37	36	
" Fat, ...	1.51	30.20	16.61	55	
" Protein (Nitrogenous Matter), . . .	9.69	193.80	98.84	51	
Non-nitrogenous Extract Matter, ...	37.77	755.40	460.79	61	
	100.00	2,000.00	874.61	–	

EXPERIMENTS WITH CORN ENSILAGE.

The silo described by Prof. M. Miles in the first annual report of the station has been sub-divided into two independent compartments of equal size, each one accessible by a separate entrance. This change has been made to meet present resources of corn fodder for ensilage, and to carry on two independent trials if desirable.

One of these silos was filled with cut corn fodder as in the previous experiments. The filling of this silo was carried on as recommended by Prof. Miles and others, *i. e.*, to fill gradually and to defer the final covering and packing down to the time when no further increase of temperature in the mass can be noticed. This course purposes to restrict and, if possible, prevent the alcoholic fermentation and subsequent formation of acetic acid in consequence of the destruction of the bacteria of fermentation by heat.

The second silo was filled with whole corn fodder, carefully spread out and at once well tramped down. After filling, the cover was put on and weighted down without delay.

The corn was in both cases kept down by an equal weight, similar to that in the trial of the previous year, — barrels filled with sand, giving a pressure of about sixty pounds to the square foot.

The corn fodder used for the filling of both silos was taken from the fertilized plats, which are described in this report in connection with the experiments concerning the effect of fertilizer on the quantity and quality of crops. The growth of each plat was divided into two parts; one-half was cut into pieces $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length, and subsequently filled into one silo, the other half was packed into the second one without being cut, as above described.

This arrangement secured, as far as practicable, for both trials, a material of a corresponding general character and

composition. The entire stock of good fodder corn at our disposal amounted to 15,272 pounds, or seven and six-tenths tons. The corn was cut when the kernels were in the milk, to secure a more nutritious ensilage than at an earlier period of growth could be expected.

There is a considerable difference in the value of a fodder corn just sending out tassels and one with kernels in the milk, like the one used in our case.

A fodder corn in the former stage of growth contains in many instances only from twelve to fifteen weight parts of dry vegetable matter in one hundred of the entire plant, whilst in the more advanced stage of growth, when the kernels are in the milk and the whole plant still green, the dry vegetable matter contained in one hundred weight parts of the entire plant varies usually between from twenty-five to twenty-eight parts; therefore, a difference of thirty-three per cent. in actual fodder, pound for pound, in favor of the latter stage of growth.

Aside from this decided advantage in actual weight, it is not less certain that the quality of the fodder obtained from the more matured fodder corn is of a superior nutritious character when compared with that of the less matured article. For the nitrogenous constituents of the more matured fodder corn, although less in quantity, are more largely of a kind (true albuminoids) better fitted for the formation of blood than they are at an earlier stage of growth. The entire plant is also richer in valuable non-nitrogenous constituents, as fat, sugar and starch, than in the latter case.

To ascertain the degree of temperature within the ensilage at the various stages of its alteration, a gas-pipe one and one-fourth inch in diameter was driven, in each case, through a tight-fitting hole in the cover of the silo to within one foot of its floors. A thermometer was kept inside of this tube to note from time to time the changes in the temperature of the ensilage. The results of these observations are stated below.

The expense for filling the silo amounted to $1.50 per ton of corn-fodder ensilage.

As the silos are not yet opened a further discussion of the silo-product has to be deferred to an early bulletin of the station.

Observations on Whole Fodder Corn in Silo.

Commenced filling the silo at 7 o'clock, A.M., September 1, and finished at 2 o'clock, P.M., the same day. The mass, with weights on, measured at once 5 ft. 4 1/4 in. in depth; first temperature observed in the tube at 3 o'clock, P.M., September 1, was 77° F. (25° C.); outside temperature, 71.6° to 73.4° F. (22° to 23° C.).

DATE.	Time of Day.	Temperature in Tube.	Temperature Outside.	Thickness of Ensilage.	Shrinkage.
Sept. 1,	5 o'clock, P.M.	77.° F.	–	5 ft. 2 3/4 in.	1 1/2 inches.
" 2,	8.30 o'clock, A.M.	78.8°	–	5 " 1 1/4 "	2 7/8 "
3,	" " "	81.5°	–	4 " 10 3/8 "	3 "
4,	" " "	85.1°	–	4 " 7 3/8 "	3 1/8 "
5,	" " "	89.6°	–	4 " 4 1/4 "	2 5/8 "
6,	" " "	89.6°	–	4 " 1 5/8 "	2 4/8 "
7,	" " "	88.7°	–	3 " 11 1/8 "	1 5/8 "
8,	" " "	93.2°	–	3 " 9 1/2 "	1 5/8 "
9,	" " "	93.2°	–	3 " 7 7/8 "	1 "
10,	" " "	94.1°	–	3 " 6 7/8 "	1 4/8 "
11,	" " "	94.1°	86.° F.	3 " 5 3/8 "	4/8 "
12,	" " "	86.°	68.°	3 " 4 7/8 "	5/8 "
13,	" " "	82.4°	57.2°	3 " 4 2/8 "	5/8 "
14,	6 o'clock, P.M.	84.2°	64.4°	3 " 3 5/8 "	2/8 "
15,	8.30 o'clock, A.M.	82.4°	53.6°	3 " 3 3/8 "	2/8 "
16,	8.30 o'clock, P.M.	82.4°	64.4°	3 " 3 1/8 "	3/8 "
17,	" " "	82.4°	68.°	3 " 2 6/8 "	3/8 "
18,	" " "	82.4°	62.6	3 " 2 3/8 "	1/8 "
19,	" " "	80.6°	55.4°	3 " 2 2/8 "	2/8 "
20,	" " "	80.6°	55.4°	3 " 2 "	1/8 "

Observations on Whole Fodder Corn, etc. — Concluded.

DATE.	Time of Day.	Temperature in Tube.	Temperature Outside.	Thickness of Ensilage.	Shrinkage.
Sept. 21,	8.30 o'clock, P.M.	79.7°	55.4°	3 " $1\frac{7}{8}$ in.	$\frac{1}{8}$ inches.
22,	" " "	78.8°	57.2°	3 " $1\frac{6}{8}$ "	0 "
23,	" " "	77.°	60.8°	3 " $1\frac{6}{8}$ "	0 "
24,	" " "	75.2°	55.4°	3 " $1\frac{6}{8}$ "	$\frac{3}{8}$ "
25,	" " "	77.°	75.2°	3 " $1\frac{3}{8}$ "	0 "
26,	" " "	74.3°	57.2°	3 " $1\frac{3}{8}$ "	$\frac{2}{8}$ "
27,	" " "	75.2°	57.2°	3 " $1\frac{1}{8}$ "	0 "
28,	" " "	74.3°	71 6°	3 " $1\frac{1}{8}$ "	0 "
29,	" " "	75.2°	71.6°	3 " $1\frac{1}{8}$ "	0 "
30,	" " "	75.2°	62.6°	3 " $1\frac{1}{8}$ "	0 "
Oct 1,	" " "	73.4°	–	3 " $\frac{7}{8}$ "	$\frac{2}{8}$ "
2,	" " "	73.4°	–	3 " $\frac{7}{8}$ "	0 "
3,	" " "	71.6°	–	3 " $\frac{6}{8}$ "	$\frac{1}{8}$ "
4,	" " "	71.6°	–	3 " $\frac{6}{8}$ "	0 "
5,	" " "	71.6°	–	3 " $\frac{6}{8}$ "	0 "
6,	" " "	69.8°	–	3 " $\frac{6}{8}$ "	0 "
7,	" " "	69.8°	–	3 " $\frac{6}{8}$ "	0 "
8,	" " "	68.°	–	3 " $\frac{6}{8}$ "	0 "
9,	" " "	–	–	– –	– –
10,	" " "	–	–	– –	– –
11,	" " "	–	–	– –	– –
18,	" " "	68.°	59.°	3 " $\frac{4}{8}$ "	$\frac{2}{8}$ "
25,	" " "	62.6°	46.4°	3 " $\frac{4}{8}$ "	0 "
Nov. 1,	" " "	62.6°	–	3 " $\frac{4}{8}$ "	0 "
8,	" " "	59.°	–	3 " $\frac{4}{8}$ "	0 "

Observations with Cut Fodder Corn in Silo.

Commenced filling the silo at 3 o'clock, P. M., September 1st, and finished at 12 o'clock, M., September 2d. Whole thickness of ensilage after levelling, taken at once, was 4 ft. $10\frac{7}{8}$ in.; temperature in the mass at 1 o'clock, P. M., September 2d, was 71.6° F. (22° C.). The weights were put on September 6th, when the temperature of the mass (122° F.) had ceased to increase.

DATE.	Time of Day.	Temperature in Tube.	Outside Temperature.	Thickness of Ensilage.	Shrinkage.
Sept. 1,	–	–	–	– –	– –
2,	–	–	–	4 ft. $10\frac{7}{8}$ in.,	– –
3,	6 o'clock, P.M.,	77.° F.,	–	– –	– –
4,	8.30 o'clock, A.M.,	78.8°	–	– –	– –
5,	" " "	82.4°	–	4 ft. $7\frac{1}{8}$ in.,	$3\frac{6}{8}$ inches.
6,	" " "	84.2°	–	4 " $6\frac{6}{8}$ "	$\frac{3}{8}$ "
7,	" " "	86.9°	–	3 " $11\frac{3}{8}$ "	$7\frac{3}{8}$ "
8,	" " "	86.9°	–	3 " $10\frac{5}{8}$ "	$\frac{6}{8}$ "
9,	" " "	86.9°	–	3 " 10 "	$\frac{5}{8}$ "
10,	" " "	87.8°	–	3 " $9\frac{5}{8}$ "	$\frac{3}{8}$ "
11,	" " "	88.7°	86.° F.,	3 " $9\frac{4}{8}$ "	$\frac{1}{8}$ "
12,	" " "	87.8°	68.°	3 " $8\frac{7}{8}$ "	$\frac{5}{8}$ "
13,	" " "	83.3°	57.2°	3 " $8\frac{4}{8}$ "	$\frac{3}{8}$ "
14,	6 o'clock, P.M.,	84.2°	64.4°	3 " $8\frac{4}{8}$ "	0 "
15,	8.30 o'clock, A.M.,	84.2°	53.6°	3 " $8\frac{4}{8}$ "	0 "
16,	8.30 o'clock, P.M.,	82.4°	64.4°	3 " $8\frac{1}{8}$ "	$\frac{3}{8}$ "
17,	" " "	82.4°	68.°	3 " $8\frac{1}{8}$ "	0 "
18,	" " "	82.4°	62.6°	3 " $7\frac{7}{8}$ "	$\frac{2}{8}$ "
19,	" " "	80.6°	55.4°	3 " $7\frac{7}{8}$ "	0 "
20,	" " "	80.6°	55.4°	3 " $7\frac{7}{8}$ "	0 "

Observations with Cut Fodder Corn, etc. — Concluded.

DATE.	Time of Day.	Temperature in Tube.	Temperature Outside.	Thickness of Ensilage.	Shrinkage.
Sept. 21,	8.30 o'clock, P.M.	78.8°	55.4°	3 " $7\frac{7}{8}$ in.	0 inches.
22,	" " "	78.8°	57.2°	3 " $7\frac{7}{8}$ "	0 "
23,	" " "	77.°	60.8°	3 " $7\frac{7}{8}$ "	0 "
24,	" " "	77.9°	55.4°	3 " $7\frac{7}{8}$ "	0 "
25,	" " "	77.°	72.5°	3 " $7\frac{7}{8}$ "	0 "
26,	" " "	76.1°	57.2°	3 " $7\frac{6}{8}$ "	$\frac{1}{8}$ "
27,	" " "	75.2°	57.2°	3 " $7\frac{6}{8}$ "	0 "
28,	" " "	75.2°	71.6°	3 " $7\frac{6}{8}$ "	0 "
29,	" " "	75 2°	71.6°	3 " $7\frac{6}{8}$ "	0 "
30,	" " "	73.4°	62.6°	3 " $7\frac{6}{8}$ "	0 "
Oct. 1,	" " "	75.2°	–	3 " $7\frac{6}{8}$ "	0 "
2,	" " "	73.4°	–	3 " $7\frac{5}{8}$ "	$\frac{1}{8}$ "
3,	" " "	73.4°	–	3 " $7\frac{5}{8}$ "	0 "
4,	" " "	73.4°	–	3 " $7\frac{5}{8}$ "	0 "
5,	" " "	73.4°	–	3 " $7\frac{5}{8}$ "	0 "
6,	" " "	73.4°	–	3 " $7\frac{5}{8}$ "	0 "
7,	" " "	71.6°	–	3 " $7\frac{5}{8}$ "	0 "
8,	" " "	–	–	– –	– –
11,	" " "	69.8°	–	3 " $7\frac{3}{8}$ "	$\frac{2}{8}$ "
18,	" " "	68.°	–	3 " $7\frac{3}{8}$ "	0 "
25,	" " "	64.4°	–	3 " $7\frac{3}{8}$ "	0 "
Nov. 1,	" " "	62.6°	–	3 " $7\frac{3}{8}$ "	0 "
8,	" " "	60.8°	–	3 " $7\frac{3}{8}$ "	0 "

The highest temperature observed in the mass was noticed at 1.30, P. M., September 4th, and registered, at about 18 inches from surface, 116.6° F. (47° C.).

Analyses of Fodder and Fodder Crops.

Analyses of Hampden Prolific Corn.

[Samples sent on for examination.]

I. Raised by J. Lyman Shepard of Westfield, Mass., upon a sandy loam soil. The ear was nine and three-fourth inches long, of a whitish color, and contained eighteen rows of kernels. The weight of the ear was 473.4 grams, and that of the cob 111.30 grams. The cob was of a red color, and comprised 23.5 per cent. of the weight of the ear, the other 86.5 per cent. being kernels. The average weight of one kernel was .433 gram.

	Moisture.	Fat.	Nitrogenous Matter. (Protein.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels, . . .	10.00	4.068	10.224	72.207	1.953	1.548

Nutritive ratio of kernels, 1 : 8.248.

II. Raised by Mrs. M. A. Clyde of Brightwood, Mass., upon a heavy soil. The ear was ten inches long, of a whitish color, and contained twenty rows of kernels. The weight of the ear was 491.4 grams, and that of the cob 107.4 grams. The cob was of a red color, and comprised 21.86 per cent. of the weight of the ear, the other 88.14 per cent. being kernels. The average weight of one kernel was 3.996 grams.

	Moisture.	Fat.	Nitrogenous Matter. (Protein.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels, ...	10.00	4.761	12.357	69.579	1.782	1.521

Nutritive ratio of kernels, 1 : 6.73.

CORN STOVER.

[From Plats of the Station, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	8.73	174.6	–	–	1 : 21.16
Dry Matter, ...	91.27	1,825.4	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	3.12	62.4	–	–	
" Cellulose, . . .	34.28	685.6	–	–	
" Fat, ...	1.27	25.4	7.62	30	
" Protein (Nitrogenous Matter), . . .	6.58	131.6	52.64	40	
Non-nitrogenous Extract Matter, ...	54.75	1,095.0	1,095.00	100	
	100.00	2,000.0	1,155.26	–	

WHEAT GRAIN.

[From Plats of the Station.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	10.58	211.60	–	–	1 : 6.42
Dry Matter, ...	89.42	1,788.40	–	–	
	100.00	2,000 00	–	–	
Analysis of Dry Matter.					
Crude Ash, . . .	2.18	43.60	–	–	
" Cellulose, . . .	2.42	48.40	–	–	
" Fat, ...	1.79	35.80	30.64	80.0	
" Protein (Nitrogenous Matter), . . .	13.35	267.00	240.30	90.0	
Non-nitrogenous Extract Matter, ...	80.26	1,605.20	1,484.81	92.5	
	100.00	2,000.00	1,755.75	–	

The composition of this article is a very fair one.

WHEAT STRAW.

[From the Plats of the Station.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	6 50	130.00	–	–	1 : 29.09
Dry Matter,	93.50	1,870.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.44	148.80	–	–	
" Cellulose,	40.74	814.80	423.70	52	
" Fat,	1.59	31.80	8.59	27	
" Protein, (Nitrogenous Matter),	5.32	106 40	27.66	26	
Non-nitrogenous Extract Matter,	44.91	898.20	359.28	40	
	100.00	2,000.00	819.23	–	

The composition of this sample is better than the average article.

PEARL MILLET (IN BLOOM).

[Collected from Plats of Station, Sept. 19, 1884.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	6.20	124 00	–	–	1 : 8
Dry Matter,	93.80	1,876.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	4.80	96.00	–	–	
" Cellulose,	35.91	718.00	–	–	
" Fat,	1.63	32 60	13.69	42	
" Protein, (Nitrogenous Matter),	7.20	144.20	86.40	60	
Non-nitrogenous Extract Matter,	50.46	1,009.20	655.98	65	
	100.00	2,000.00	756.07	–	

COMMON MILLET.

[Collected from Plats of Station, when blooming, Aug. 14, 1883.]

I.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	6.15	123.00	-	-	1 : 8.32
Dry Matter,	93 85	1,877.00	-	-	
	100.00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash,	4.67	93.40	-	-	
" Cellulose,	29.80	596.00	-	-	
" Fat,	2.04	40.80	17.14	42	
" Protein (Nitrogenous Matter),	7.69	153.80	92.28	60	
Non-nitrogenous Extract Matter,	55.80	1,116.00	725.40	65	
	100.00	2,000.00	834.82	-	

COMMON MILLET.

[From Plats of the Station, when fully matured, Sept. 3, 1883.]

II.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	6.73	134.60	-	-	1 : 8.5
Dry Matter,	93.27	1,865.40	-	-	
	100.00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash,	4.23	84.60	-	-	
" Cellulose,	33.39	667.80	-	-	
" Fat,	2.67	53.40	21.36	40	
" Protein (Nitrogenous Matter),	7.09	141.80	85.08	60	
Non-nitrogenous Extract Matter,	52.62	1,052.40	631.44	60	
	100.00	2,000.00	737.88	-	

The analyses of both samples point towards an exhausted condition of the soil on which they were raised.

HUNGARIAN GRASS (Panicum Germanicum).

[From the Farm of Levi Adams, Hadley, Mass., collected in bloom, Sept. 4, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	7.45	149.00	–	–	1 : 6.22
Dry Matter,	92.55	1,851.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	5.73	114 60	–	–	
" Cellulose,	31 96	639.20	–	–	
" Fat,	2.22	44.40	18.65	42	
" Protein (Nitrogenous Matter),	9.45	189.00	113.40	60	
Non-nitrogenous Extract Matter,	50.64	1,012.80	658.32	65	
	100.00	2,000.00	790.37	–	

The composition of the above sample is very fair.

BARNYARD GRASS (Panicum crus-galli.)

[Collected in bloom from College Farm, Aug. 14, 1883.]

	Percentage Competition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	6.65	133.00	–	–	1 : 2.94
Dry Matter,	93.35	1,867.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	10.82	216.40	–	–	
" Cellulose,	33.72	674.40	–	–	
" Fat,	1.95	39.00	16.34	42	
" Protein (Nitrogenous Matter),	15.27	305.40	183.24	60	
Non-nitrogenous Extract Matter,	38.24	764.80	497.12	65	
	100.00	2,000.00	696.74	–	

This grass is found quite frequently around barns and compost heaps as a weed. The analysis of the above sample

shows strikingly the influence of a liberal manuring on the composition of the species of plants of which it is a variety.

CORN MEAL.

93.28 per cent. passed through mesh 144 to square inch, Sept, 1884.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	11.95	239.00	–	–	1 : 7.42.
Dry Matter,	88.05	1,761.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.59	31.80	–	–	
" Cellulose,	2.59	51.80	17.61	34	
" Fat,	4.43	88.60	67.34	76	
" Protein (Nitrogenous Matter),	13.13	262.60	223.21	85	
Non-nitrogenous Extract Matter,	78.26	1,565.20	1,471.29	94	
	100.00	2,000.00	1,779.45	–	

CORN MEAL.

91.4 per cent. passed through mesh 144 to square inch, August and September, 1884.

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.40	248.00	–	–	1 : 9.25
Dry Matter,	87.60	1,752.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.66	33.20	–	–	
" Cellulose,	2.71	54.20	18.43	34	
" Fat,	4.14	82.80	62.93	76	
" Protein (Nitrogenous Matter),	10.77	215.40	183.09	85	
Non-Nitrogenous Extract Matter,	80.72	1,614.40	1,517 54	94	
	100.00	2,000.00	1,781.99	–	

SUGAR BEET PULP. (DIFFUSION MODE.)

[From the Franklin Factory.]

	Per Cent.
Moisture at 100° C.,	89.680
Dry Matter at 100° C.,	10.320
Organic Matter,	10 201
Ash,	0.107
Fat,	0.098
Crude Fibre,	2.450
Non-nitrogenous Extract Matter,	6.384
Nitrogenous Matter,	1.281

	Percentage Composition.	Constituents (in lbs.) in a Ton of 2,000 lbs.	Pounds Digestible in a Ton of 2,000 lbs.	Per Cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	89.68	1,793.60	–	–	1 : 7.1
Dry Matter,	10.32	206.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	1.04	20.80	–	–	
" Cellulose,	23.74	474.80	474.80	100	
" Fat,	.95	19.00	19.00	100	
" Protein (Nitrogenous Matter),	12.41	248.20	248.20	100	
Non-nitrogenous Extract Matter,	61.86	1,237 20	1,237.20	100	
	100 00	2,000.00	1,979.20	–	

EXPERIMENTS WITH SPECIAL FERTILIZERS IN FRUIT CULTURE.

CURRANTS AND PEACHES.

The experiments with currants, which are described in the subsequent communication, are but a continuation of an investigation inaugurated upon the college grounds ten years ago.

Field experiments with sugar beets, for the purpose of ascertaining the influence of special fertilizers on the saccharine qualities, suggested the extension of the inquiry to fruit-bearing plants.

For the sake of brevity, and of a desirable understanding of the points involved, I reproduce here the introduction of one of the first publications on the subject under discussion: "The question whether a systematic and rational manuring of our fruit-bearing plants is essential for the continued production of good crops, engages more attention from year to year. Judging merely from the results obtained in general farm management, in consequence of the adoption of the rule to restore annually to the soil under cultivation, either the entire amount or in part, as circumstances may advise, those of its constituents which the crops carried off have abstracted, it seems but reasonable to assume that the same principle applied to the cultivation of fruit and garden crops in general, must prove in the end most advantageous, as far as quality and quantity of the crops resulting are concerned.

A liberal supply, in particular, of those essential elements of plant food which are found in the fruits in conspicuous quantities and for obvious reasons must serve important functions in their growth, if judiciously provided cannot otherwise but prove beneficial to the entire plant.

To secure that amount in a more definite form than as a general rule has been customary, improves most decidedly our chances to ascertain, not only the special wants of the plants under cultivation, but to recognize also the particular form in which the various elements of plant food exert their most valuable influence on the quality of the crops. Believing in the correctness of these views, I entered a few years ago upon a series of analytical chemical inquiries to determine the character of the ash constituents of fruits, and to study, also, the relations which apparently exist between the variations in the composition of the former and the quality of the latter, for the purpose of furnishing information needed for the *successful* introduction of a *rational system* of *fertilization* of our *fruit-bearing plants*."

These investigations have been carried on since without serious interruption, as far as the limited resources of past years for experimental work of that character have permitted. The scarcity of previous systematic chemical inquiries into the relations existing between the kind and the amount of available plant food in a productive garden soil or orchard, and the absolute and relative quantity of the various soil constituents contained in the fruit and garden crops raised upon it, rendered it necessary to grow them under well defined circumstances, to obtain material fit for comparative analyses.

The necessity of adopting that course of action became still more apparent, when considering the extraordinary influence — quite generally conceded — of soil, location and season on the quality of these crops. Products raised by the aid of different manurial substances, within the *same season*, upon a *similar soil*, and of a *corresponding stage of growth*, had to be secured for the examination, to impart a scientific and practical value to the analytical results.

It is a well-known fact that the *absolute amount* of the mineral constituents of plants of the same variety, and of one and the same species, even, may differ widely, yet, as a rule, this circumstance does not necessarily alter the general character of the plants.

A change, however, in the *relative proportion* of the various mineral constituents, as potassa, lime, etc., rarely has

been noticed without having affected the quantity of some of the organic constituents, as sugar, starch, acids, etc.

The fact that the essential mineral constituents (potassa, calcium, magnesium, iron and phosphorus) of our farm plants cannot replace each other beyond a certain extent in the vegetable economy without endangering their life, points towards a *specific* function of each of them in the growth of these plants. We have learned, by experimental observation, what elements are indispensable for a healthy growth, and a successful reproduction of these plants. It remains for us, then, to ascertain the particular function of each of the above elements in the life of plants. The more we learn of the specific functions of each essential mineral constituent of plants, the better will we be prepared to perfect our system of manuring; to cultivate with a view of developing desirable qualities in the crops, and to counteract the serious influences of an abnormal composition of the sap, on the life of plants.

To secure suitable material for an examination in the above-mentioned direction, five experimental plats were set apart for that purpose in 1875. They were planted under the direction of Prof. Maynard, with strawberries, raspberries, currants and blackberries, besides cherry, plum, pear and apple trees. Four of these plats received, annually, a certain kind and amount of chemical manure (see currant experiments), while one plat received no manure. Upon each plat were planted the same kind and variety of fruits. Some interesting observations made on grape-vines and strawberries have been already published in the annual reports of the college, in the report of the Massachusetts State Board of Agriculture for 1879, and elsewhere. A brief description of experiments with healthy peach trees, and with trees suffering with "the yellows," has been published in the report of the Massachusetts Horticultural Society, and of the State Board of Agriculture for 1882. A more detailed description of these experiments, in particular, will be found in the annual report of the Board of Control of the State Experiment Station, for 1883. The experiments with currants, below described, furnish an interesting addition to previous observations.

Experiments with Currants.

Red Currants (Versailles).

The plants furnishing the fruits for the examination had been for several years under special treatment upon five different experimental plats. The ground upon which these plats are located has served, for years previous to its present use, for the production of grass. The soil consists of a light gravelly loam. Each plat covers an area of 4.2000 square feet; four of them have received, annually, for five to six years past, a definite amount and kind of special chemical manure, while one plat received none. The fertilizer was applied broadcast early in the spring, and subsequently incorporated in the soil by means of a cultivator. The plats were otherwise treated alike to secure a good mechanical condition of the soil, and to keep off the weeds.

Fertilizers Applied.

Plat I. received annually forty-five pounds of dissolved boneblack, containing from ten to twelve per cent. of soluble phosphoric acid, and fifteen pounds of potash nitre (saltpetre).

Plat II. received annually fifteen pounds of potash nitre and thirty pounds of kieserite.

Plat III. received annually forty-five pounds of dissolved boneblack, fifteen pounds of potash nitre and thirty pounds of kieserite.

Plat IV., nothing applied.

Plat V. received annually forty-five pounds of dissolved boneblack, eighteen pounds nitrate of soda (Chili saltpetre) and fifteen pounds of muriate of potash.

Nitrogen was applied in form of nitric acid, to secure a uniform action of that element.

Well-matured fruits were in every instance secured for the tests. They were collected July 18, 1883, and examined without delay.

One hundred parts by weight of the berries contained, —

	I.	II.	III.	IV.	V.
Dry vegetable matter, .	13.76	13.61	15.72	12.95	13.86
Water at 100° C., . .	86.24	86.39	84.28	87.05	86.14
Ash in dry matter, . .	.45	.45	.48	.41	.45

An examination of the composition of the berries showed the highest color, the largest amount of vegetable matter, and the largest amount of mineral constituents in the fruits from Plat III. The fruits from Plat V. rank next in regard to these qualities, yet exceed in sugar by more than one per cent.

The fruits from Plat IV. (without fertilizer) rank lowest in quality. The examination of the organic constituents of the berries will be repeated during the coming season, when more details will be published.

Ash Analysis of Fruit with Stems.

PLATS.	I.	II.	III.	IV.	V.
Sesquioxide of iron, .	1.84	.99	.95	1.20	.75
Potassium oxide, . .	54.35	56.12	54.32	47.68	59.34
Sodium oxide, . . .	5.42	2.35	2.56	4.02	4.04
Magnesium oxide, . .	4.10	5.08	5.49	6.23	4.61
Calcium oxide, . .	15.96	17.21	17.68	18.96	14.69
Phosphoric acid, . .	18.33	18.25	19.00	21.91	16.57
	100.00	100.00	100.00	100.00	100.00

The result of these analyses of the currants are calculated and reported with reference only to the several constituents mentioned in the above statement, for the purpose of rendering the variations in their quantitative relations more conspicuous. Other ash constituents, as sulphur, chlorine and silica, are for the present for various reasons excluded from

the discussion. A careful consideration of the composition of the ash obtained from fruits raised upon the *unfertilized* plat (IV.), as compared with any of those obtained from fruits raised upon the *fertilized* plats, cannot fail to lead to the conclusion, that the unfertilized soil contained an ample supply of available phosphoric acid, magnesia, soda and iron; for even an actual addition of these important plant constituents, in the form of fertilizer, to the soil of Plats I., III. and V., failed to increase the quantity of these constituents above that found in the ash of fruits raised upon the unfertilized plat. The only ash constituent in which the unfertilized soil seems apparently to have been deficient, is available potassa.

An addition of potash compounds to the soil has in every instance increased the percentage of potassa in the fruits, varying from six to eleven and more per cent. The fruit gathered from Plat V. showed the most remarkable difference in that direction. Potash fertilizers have decidedly improved desirable qualities in the fruits; those from Plat V. proved the most saccharine.

Aside from the practical lessons which may be gleaned from the above described experiment, there is another feature of the analytical results deserving a serious consideration; namely, the *increase* of *potassa* in the currants is invariably accompanied by a *corresponding decrease* of phosphoric acid, and of *lime* in particular. This result coincides with my previous observations concerning the action of potash fertilizers on grapes, strawberries and peaches.

The circumstance that the most striking alteration in the mineral constituents of the currants has been produced by muriate of potash, seems to be of particular interest in connection with some of my previous experiments regarding the effects of that potash compound on *diseased peach trees.*

The examination of fruits and of young branches from peach trees affected by

"The Yellows"

disclosed the fact that they contained a large amount of lime, and more phosphoric acid than fruits and young branches collected from healthy peach trees of the same variety.

This condition of diseased peach trees has since been recognized by Dr. R. C. Kedzie, — on trees raised in Michigan, — in a letter to J. P. Leland, published Jan. 29, 1884, in the Allegan "Gazette."

It is also found, in our experiments, that a repeated application of muriate of potash, in connection with a judicious pruning, restored the affected trees to a vigorous growth, and the new branches and fruit to a normal amount of potassa, lime and phosphoric acid. The excess of lime disappeared in both fruit and branches, and the trees are reported by Prof. Maynard as restored to a healthy bearing condition.

The observations on currants (Plat V.) furnish an additional illustration of the beneficial effects claimed by me for the muriate of potash.

The importance of the interests involved renders a fair trial desirable elsewhere. The details of the mode of operation are published in the First Annual Report of the Board of Control of the Experiment Station. The director of the station has asked to be favored with information regarding the results obtained.

It is gratifying to be able to state that the treatment of peach trees, recommended on previous occasions, has been carried out extensively in various localities with many encouraging results.

MISCELLANEOUS ANALYSES.

ASPARAGUS.

	Stems.	Roots.
Moisture at 100° C.,	5.53	4.85
Dry matter,	94.47	95.15
Nitrogen in dry matter,	1 98	1.48
Insoluble in acids,	.08	3.67

One hundred parts of crude ash contained:—

	Stems.	Roots.
Potassium oxide,	42.94	56.43
Sodium oxide,	3.58	5.42
Calcium oxide,	27.18	15.48
Magnesium oxide,	12.77	7.57
Phosphoric acid,	12.31	15.09
Sesquioxide of iron,	1.22	Not determined

The examination has been carried on at the especial request of several garden farmers in the eastern part of the State. The plants serving for the analysis were raised upon the college grounds, upon a light, loamy soil, which previously had been occupied by grasses.

The comparatively small amount of soda in the ashes of both stems and roots confirms the impression that the beneficial influence of common salt on asparagus beds, not unfrequently reported, is due rather to its action on the physical condition of the soil than to its requirement as plant food. The common salt increases the hydroscopic quality of the soil, assists in the diffusion of potassa and phosphoric acid, and rarely supplies deficiencies in the soil, as far as its own constituents are concerned. A judicious application of muriate of potash, with sulphate of magnesia (Kieserite) tends to secure available potash throughout the entire body of the soil penetrated by the extensive root mass of the plants.

Analysis of the Ash of the Clinton Grape.

	A.	B.
Sesquioxide of iron,	.88	.91
Potassium oxide,	57.40	59.49
Sodium oxide,	3.51	59.49
Magnesium oxide,	7.24	7.50
Calcium oxide,	13.10	13.58
Phosphoric acid,	17.87	18.51
	100.00	100.00

Analysis of the Baldwin Apple (Matured).

One hundred parts of ash, soluble in hydrochloric acid, contained:—

Sesquioxide of iron,	1.08
Potassium oxide,	63.54
Sodium oxide,	1.71
Magnesium oxide,	5.52
Calcium oxide,	7.28
Phosphoric acid,	20.87
Insoluble in hydrochloric,	3.68

Analysis of the Ash of Corn Cobs (Longfellow Variety).

One hundred parts of cobs contained:—

Moisture of cobs at 100° C.,	12.00
Ash (crude),	1.38
Organic matter,	86.62

One hundred parts of the ash contained:—

Potassium oxide,	65.89
Sodium oxide,	2.94
Calcium oxide,	2.61
Magnesium oxide,	3.22
Ferric oxide,	1.16
Phosphoric acid,	5.44
Silica and sand,	18.74

The per cent. of potash present is as large as that found in many of our cultivated grapes.

Ash Analysis of Beet-sugar Molasses.

[From Roots grown on College grounds.]

Moisture,	5.27	
Potassium oxide,	24.60	per cent.
Sodium oxide,	15.84	" "
Magnesium oxide,	2.24	" "
Calcium oxide,	9.10	" "

Phosphoric acid,	trace.
Iron oxide,	1.44 per cent.
Silicic acid,	3.66 " "
Carbonic acid, chlorine, and sulphuric acid,	not determined.

As the molasses had been treated with boneblack, the phosphoric acid had been abstracted, and the relative proportion of other mineral constituents of the sugar beet, altered. The potash obtained from the molasses of the sugar beet is considered valuable for the manufacture of the finer qualities of glass. The beet-sugar manufacturer usually changes, by fermentation, the sugar of the molasses into alcohol; and evaporates the refuse of the still to dryness, and chars the refuse. The potash is abstracted from the charred mass in a similar way as from any other ash.

Ozone.

"*The most valuable article in the world.*"

[Prentiss Preserving Co., Cincinnati, Ohio. Sent on for examination by the "New England Homestead," Springfield, Mass.]

Moisture at 100° C. (including a trace of aromatic matter),	0.800 per cent.
Carbon,	6.080 " "
Ash,	.600 " "
Sulphur,	92.52 " "

The pretensions of the manufacturer regarding the value of this compound are not less strange than the name under which it is offered for sale.

The Phœnix Fruit Tree Invigorator.

(Manufactured by the Phœnix Fruit Tree Invigorator Co., of Livonia, Livingstone, County, N. Y.)

"*A specific for the Aphis on Fruit Trees and Berry Bushes of all kinds.*"
"*Patent Secured.*"

[Sent on for examination by the editor of the "New England Homestead," Springfield, Mass.]

One hundred parts of the material contained:—

Moisture at 100° C.,	21.75
Sulphur free,	41.25
Sulphur combined (with alkalies),	1.66
Sulphuric acid,	.64
Phosphoric acid,	.82
Chlorine,	.20
Carbonic acid,	9.54

Ferric oxide,	.68
Magnesium oxide,	1.13
Potassium oxide,	3.34
Calcium oxide,	14.08
Small quantities of soda with coal, etc.,	2.07
Ash constituents insoluble in acids,	2.84
	100.00

Claims of the Manufacturer.

"This compound, when applied to plants or trees, is taken up by the circulation of the sap, and carried by it to the leaves, where it is reorganized and distributed to all parts of the tree, giving the tree a healthy leaf, and a vigorous growth.

"Price, per pound box, $1.50."

Directions given by the Manufacturer for use.

"For Fruit Trees. Bore into the trunk of the tree, near the ground, with $\frac{5}{8}$ bit till the heart is nearly reached; and fill the opening with the Phœnix Fruit Tree Invigorator, and close tight with a thin cork, or grafting wax. A wooden stopper may be used. Apply any time during the winter and spring, till the first of June.

"For Berry, Currant, Rose Bushes, and house plants. Remove the dirt and rough bark from the roots, and apply the invigorator, covering again with dirt."

The mode of applying the offered remedy for the destruction of insect life, and for the promotion of a healthful growth of plants, requires certainly a serious operation, and a first trial, if at all contemplated, ought to be carried out on a limited scale. The proposition to introduce the remedy directly into the circulation of the plant, is not without its analogy in the treatment of animals. One point, however, must be cheerfully conceded — the patentee means to get a liberal pecuniary compensation for his claimed discovery. A mixture of an essentially corresponding composition may be produced at an expense of from twelve to fifteen cents per pound, at retail cost, by taking from 40 to 42 pounds of flour of sulphur, and 58 to 60 pounds of sifted wood ash.

Analysis of a Bowel Stone discharged by a Horse.

[Obtained from Dr. Cressey.]

Moisture at 100° C.,	1.70 per cent.
Organic and Volatile Matter,	43.90 " "
Ash,	56.10 " "
Nitrogen (total),	1.455 " "

Phosphoric acid,	0.885	per cent.
Calcium oxide,	41.170	" "
Carbonic anhydride,	30.60	" "

One hundred parts contained: —

Moisture at 100° C.,	1.700	per cent.
Carbonate of lime,	69.546	" "
Tricalcic phosphate,	1.935	" "
Nitrogen containing organic matter,	26.819	" "
	100.000	

Analysis of a Urinary Calculus found in the Bladder of a Hog.

[Obtained from Dr. Cressey.]

One hundred parts contained: —

Moisture at 100° C.,	8.650	per cent.
Tricalcic phosphate,	10.981	" "
Carbonate of lime,	8.688	" "
Phosphate ammoniate of magnesia,	7.710	" "
Nitrogen containing organic matter,	63.971	" "

Diabetic Urine.

[Sent on for examination from Amherst.]

Specific gravity,	1.04	per cent.
Reaction (acid),		
Solids,	8.40	" "
Grape sugar,	6.95	" "
Mineral matter (in solids),	1.31	" "

Containing calcium, phosphoric acid, chlorine, potassium oxide, nitrogen, etc.

Sewage Water.

[Samples sent on by the Secretary of the State Board of Agriculture, John E Russell.]

One hundred thousand parts contained: —

Solids,	1064.00	per cent
Chlorine,	491.20	" "
Sulphuric acid,	71.23	" "
Phosphoric acid,	traces.	
Magnesium oxide,	57.29	" "
Calcium oxide,	20.20	" "
Sodium oxide,	182.98	" "
Potassium oxide,	5.50	" "
Total nitrogen,	8.34	" "
Nitrogen in free ammonia,	3.22	" "
Nitrogen in dry matter,	5.12	" "

This water contains considerable quantity of saline constituents peculiar to the water of the ocean.

VALUATION OF FERTILIZERS, AND FERTILIZER ANALYSES.

Trade Values of Fertilizing Ingredients in Raw Materials and Chemicals.

	Cents per Pound.			
	1881.	1882.	1883.	1884.
Nitrogen in ammonia salts, ...	22½	29	26	22
Nitrogen in nitrates, ...	26	26	20	18
Nitrogen in dried and fine ground fish, .	20	24	23	20
Organic nitrogen in guano, and fine ground blood and meat, ...	20	24	23	18
Organic nitrogen in cotton seed, linseed meal, and in castor pomace, . . .	16	18	18	18
Organic nitrogen in fine ground bone, .	15	17	17	18
Organic nitrogen in medium fine bone, .	14	15	15	16
Organic nitrogen in medium bone, . .	13	14	14	14
Organic nitrogen in coarse medium bone,	12	13	13	12
Organic nitrogen in coarse bone, horn shavings, hair, and fish scraps, . .	11	11	11	10
Phosphoric acid, soluble in water, . .	12½	12½	11	10
Phosphoric acid, soluble in ammonia citrate,*	9	9	8	9
Phosphoric acid, insoluble in dry, fine ground fish, and in fine bone, . . .	6	6	6	6
Phosphoric acid, insoluble in fine medium bone, ...	5½	5½	5½	5½
Phosphoric acid, insoluble in medium bone,	5	5	5	5
Phosphoric acid, insoluble in coarse medium bone, ...	4½	4½	4½	4½
Phosphoric acid, insoluble in coarse bone,	4	4	4	4
Phosphoric acid, insoluble in fine ground rock phosphate, ...	3½	3	2¾	2¼
Potash as high-grade sulphate, ...	7½	7	7	7¼
Potash as kainite, ...	5½	5	4¼	4¼
Potash as muriate, ...	4½	5	4¼	4¼

* Dissolved from two grams of phosphate, unground, by 100 c. c. neutral solution of ammonia citrate, sp. gr. 1.09 in 30 minutes at 40 deg. C., with agitation once in five minutes; commonly called "reverted" or backgone phosphoric acid.

The above trade values are the figures at which, on March 1, 1884, the respective ingredients could be bought at retail, for cash, in our markets in the *raw materials*, which

are the regular source of supply. They also correspond to the average wholesale quotations.

The calculated values obtained by the use of the above figures will be found to agree with the reasonable retail price in case of standard raw materials, such as, —

Sulphate of Ammonia,	Azotin,
Nitrate of Soda,	Dry Ground Fish,
Muriate of Potash,	Cotton Seed,
Sulphate of Potash,	Castor Pomace,
Dried Blood,	Bones,

Plain Superphosphates.

The particular rate of valuation of each ingredient used for manurial purposes depends, in many instances, largely on its mechanical condition and its peculiar form of combination. For instance, in factory-waste, and animal and vegetable refuse of various descriptions.

It has been the aim in previous reports of the station to describe briefly, in connection with analytical reports regarding their composition, the peculiar character and special merits of prominent agricultural chemicals, and of refuse materials of various industries which are commonly used for the manufacture of compound fertilizers for farm purposes.

This feature of the reports will be retained for the future wherever an inducement is offered. The information thus far given on these occasions may be improved by studying the official annual reports on commercial fertilizers published for ten years past in the report of the Massachusetts State Board of Agriculture. A knowledge of the sources and of the character of the ingredients which serve largely for the manufacture of our commercial fertilizers, leads quite naturally to a due appreciation of the importance of securing the *proper form* for our circumstances. No mode of supplying our special wants of plant food for a successful and economical cultivation of crops is as safe as the practice to supplement, if needed, our home-made manures with commercial fertilizing ingredients, in the form of suitable raw materials and chemicals to meet our wants; and if obliged to increase our home resources of manure, to compound them from the most suitable stock in the market. Although a first trial of that course of action may not realize

all the advantages expected, there can be no doubt about the correctness of the statement, that the best financial success on the part of the farmer can only be secured by the gradual adoption of that system of manuring the farms.

Our leading dealers in fertilizers begin to realize the late tendency in their trade, and are preparing to meet the call. There is every reason to assume that the consumption of chemical manurial matter will increase in the same proportion as the principles of a rational and economical system of manuring become better understood.

The results of an examination and a discussion of all fertilizers sold under a special license are reported according to our State laws, by the inspector, to the State Board of Agriculture, and will be found in the report of the Secretary of the Board for 1884.

Ammonium Sulphate.

[I. Collected of D. A. Horton, Northampton, Mass. Guaranteed 25 per cent. of ammonia.]

[II. Sent on for examination by M. W. Jefts, for the Ashby Farmers' Club, Ashby, Mass.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	1.88	0.42
Ammonia,	25.07	24.00
Valuation per 2,000 lbs.,	$90 64	$87 12

The cost of this article has varied widely at times; the valuation is based on our annual rate, 22 cents per pound of nitrogen in ammonia salts.

Chili Saltpetre.

[Collected at Amherst, Mass.]

Moisture at 100 C.,°	1.98
Nitrogen (in nitric acid),	14.44
Valuation per 2,000 lbs.,	$51 98

Muriate of Potash.

[I. Sent on by M. W. Jefts, for Ashby Farmers' Club, Ashby, Mass.]

[II. Collected of Boston Fertilizer Co., by C. P. Preston, Danvers, Mass.]

[III. Collected of Bowker Fertilizer Co., at Amherst, Mass.]

	Pounds per Hundred.		
	I.	II.	III.
Moisture at 100° C.,	1.00	0.05	0.90
Potassium oxide,	51.94	49.60	50.80
Valuation per 2,000 lbs.,	$14 15	$42 16	$43 18

This form of potash compounds has proved to be one of the most reliable potash resources for field and garden.

Kainite.

[Collected of D. A. Horton, Northampton, Mass.]

Moisture at 100° C.,	2.15
Calcium oxide,	.82
Magnesium oxide,	11.30
Potassium oxide,	16.48
Sulphuric acid,	21.91
Valuation per 2,000 lbs.,	$14 08

This is a fair sample of its kind. Potash, in form of kainite, has been applied with much success for forage crops. It deserves a careful trial upon pastures and meadows, in connection with bone fertilizers.

Refuse Salt.

[Collected of R. T. Prentiss, Holyoke, Mass.]

Moisture at 100° C.,	1.70
Calcium oxide,	1.21
Magnesium oxide,	.41
Sulphuric acid,	1.57
Sodium chloride,	95.38

The article is a fair specimen of its kind. A detailed discourse of the various kinds of salt used for agricultural purposes, etc., may be found in the annual report of the Massachusetts State Board of Agriculture for 1869, page 18.

Crude Kieserite.

[Of Randall Fertilizer Co., Boston, Mass. Sent on by C. P. Preston, Danvers, Mass.]

Moisture at 100 C.,	28.12
Magnesium oxide,	17.45
Calcium oxide,	3.13
Sulphuric acid,	36.87
Insoluble matter,	3.62

The sample contained 48.6 per cent. of sulphate of magnesia, from 7 to 8 per cent. of gypsum, and 2.23 per cent. of chloride of magnesium; it is consequently of fair quality. The kieserite, as an absorber of ammonia, may profitably be used in many instances as a substitute for gypsum.

Nova Scotia Plaster (Gypsum).

[Collected of R. T. Prentiss, Holyoke, Mass.]

	Pounds per Hundred.
Calcium oxide,	32.17
Magnesium oxide,	1.40
Sulphuric acid,	44.00
Insoluble matter,	.70

The sample contains 94.8 per cent. of gypsum, and is a fair article. The customary market price in our vicinity is $9 per ton.

Onondaga Plaster (Gypsum).

[Collected of Sheldon & Newcomb, Greenfield, Mass.]

	Pounds per Hundred.
Calcium oxide,	29.15
Magnesium oxide,	3.89
Sulphuric acid,	31 82
Insoluble matter,	9.25

This article sells at $6 per ton; its cost corresponds well with its percentage of gypsum, — 67 to 68 per cent.

Onondaga Plaster.

[Collected of H. D. Fearing, Amherst, Mass.]

	Per cent.
Moisture,	22.25
Calcium oxide,	29.80
Magnesium oxide,	4.32
Sulphuric acid,	31.58
Carbonic acid,	8.80
Insoluble matter,	10.70

This sample contains a considerable amount of carbonate

of lime, and resembles closely the previous one, where no special determination of carbonic acid has been recorded.

Lime-Kiln Ashes.

[I. Collected of R. T. Prentiss, Holyoke, Mass.]
[II. Collected of J. A. Sullivan, Northampton, Mass.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	30.70	20.55
Calcium oxide,	37.55	45.53
Magnesium oxide,	3.68	1.80
Potassium acid,	1.70	1.35
Phosphoric acid,	1.27	2.92
Carbonic acid,	17.83	21.10
Sulphuric acid,	–	–
Insoluble matter,	3.30	8.23

I. These ashes sold at 22 cents per bushel.

II. Sold at 18 cents per bushel at retail, and 12½ cents per bushel by the car-load. They consist in the main of a mixture of carbonate and slacked lime.

Wood Ashes.

[I. Ashes sent on for examination from Northfield, Mass.]
[II. Western ashes (leached) sent on for examination from Hingham, Mass., by Edmund Hersey, for the Hingham Agricultural and Horticultural Society.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	27.47	24.53
Calcium oxide,	30.50	26.53
Magnesium oxide,	2.81	3.03
Potassium oxide,	1.25	.79
Phosphoric acid,	1.98	1.89
Insoluble matter,	10.55	21.71

Wood ash ought to be bought and sold on guaranty of composition; inferior wood ashes are liable to come from all sections of the country.

The composition of the sample of leached ashes (No. II.) resembles closely that of a previously reported one from Detroit, Mich. (See Bulletin 5, No. 108; or First Annual Report, page 102.)

[I. Canada ashes, sent on by H. C. Haskell, of Deerfield, Mass.]
[II. Canada ashes, sent on by Edmund Hobart, North Amherst, Mass.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	15.37	28.57
Ash (dried),	84.63	71.43
Calcium oxide,	35.65	27.02
Potassium oxide,	3.64	5.06
Magnesium oxide,	2.38	2.75
Phosphoric acid,	2.11	1.07
Insoluble matter,	7.95	9.34

Ashes.

[Sent on by Messrs. John B. Moore & Son, Concord, Mass.]

	Per cent.
Moisture at 100° C.,	8.60
Calcium oxide,	35.80
Potassium oxide,	4.25
Magnesium oxide,	3.91
Phosphoric acid,	2.01
Insoluble matter,	16.08

Fertilizer.

[Sent on by W. H. Earl & Co., Worcester, Mass.]

	Per cent.
Moisture at 100° C.,	26.20
Ash,	28.15
Organic and volatile matter,	71.85
Calcium oxide,	20.59
Phosphoric acid,	.45
Nitrogen,	2.63
Insoluble matter,	1.95

As the nitrogen in this material is present in the form of

leather refuse which has been treated with lime, no valuation is stated, as it must be valued by testing in the field.

Ground Horn.

[Of Perkins & Bradstreet, Danvers, Mass. Sent on for examination by J. J. H. Gregory, Marblehead, Mass.]

Moisture at 100° C.,	10.00
Organic and volatile matter,	95.00
Ash,	5 00
Phosphoric acid,	1.36
Nitrogen in organic matter,	13.53

Valuation per 2,000 Pounds.

270.6 lbs. nitrogen at 10 cents,	$27 06
27.2 lbs. phosphoric acid at 4½ cents,	1 22
	$28 28

The inferior mechanical condition of the article advises the low valuation of the nitrogen present.

Boneblack.

[I. Collected of B. F. Bridges, South Deerfield, Mass.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	1.55	2.50
Phosphoric acid,	30.54	23.47
Ash,	80.85	58.45
Calcium,	45.73	–
Valuation per 2,000 lbs.,	$27 49	$21 12

Boneblack refuse, in a fine ground condition may be profitably used for composting.

Ground South Carolina Phosphate.

[Sent on by the Ashby Farmers' Club, Ashby, Mass.]

	Per cent.
Moisture at 100° C.,	1.90
Total phosphoric acid,	27.13
Insoluble matter,	11.90
Valuation per 2,000 lbs.,	$12 21

The value of the phosphate last mentioned depends largely on its mechanical condition.

Dissolved Boneblack.

[I. Sent on by M. W. Jefts, for the Ashby Farmers' Club, Ashby, Mass.]
[II. Sent on for examination.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	11.05	10.50
Total phosphoric acid,	18.87	18.48
Soluble phosphoric acid,	17.83	16.18
Reverted phosphoric acid,	.53	.78
Insoluble phosphoric acid,	.51	1.52
Insoluble matter,	.83	.70
Valuation per 2,000 lbs.,	$37 26	$35 58

Lobster Shells.

[Sent on for examination by J. Shedd, 90 Waltham St., Boston, Mass.]

Moisture at 100° C.,	7.27
Calcium oxide,	22.24
Magnesium oxide,	1.30
Phosphoric acid,	3.52
Nitrogen,	4.50
Insoluble matter,	.27

The material sent on consisted of coarse pieces of shells with meat mass in a dry condition. The large percentage of carbonate of lime present tends to promote a rapid decomposition of the organic nitrogenous matter, and favors thus a speedy action of the lobster shells, when dried and ground before their application. Counting phosphoric acid in the coarsely ground material $4\frac{1}{2}$ cents per pound, and nitrogen 20 cents per pound, its commercial value would be from $22 to $23 per ton.

Ground Bones.

[Sent on by farmers near Bolton, Mass.]
[I. Coarse Bones.]
[II. Fine Ground Bones.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	5.67	5.68
Ash,	67.75	64.75
Total phosphoric acid,	27.17	25.90
Reverted phosphoric acid,	7.21	7.00
Insoluble phosphoric acid,	19.98	18.90
Nitrogen,	3.51	3.26
Insoluble matter,	2.28	.65
Valuation per 2,000 lbs.,	$45 00	$42 65

Penguin Island Guano.

[Sent on for examination.]

Guaranteed composition: Bone phosphate, 51.76 per cent. (equal to 23.07 phosphoric acid); ammonia, 1.43 per cent. (equivalent to nitrogen 1.18 per cent.).

Moisture at 100° C.,	12.10
Total phosphoric acid,	24.35
Soluble phosphoric acid,	.35
Reverted phosphoric acid,	6.97
Insoluble phosphoric acid,	17.03
Potassium oxide,	.14
Nitrogen in organic matter,	.23
Nitrogen in ammonia salts,	.26
Nitrogen in nitrates,	.24
Total nitrogen,	.73
Valuation per 2,000 lbs.,	$31 62

This article deserves a careful trial upon lands rich in organic matter; in particular, upon moist grass lands.

Cuba Guano.

[Sent on from Boston. Mass.]

One hundred parts contain: —

	Raw. Per cent.	Dried. Per cent.
Moisture at 100° C.,	36.57	22.57
Total phosphoric acid,	11.34	13.73
Soluble phosphoric acid,	.89	1.06
Reverted phosphoric acid,	3.52	4.45
Insoluble phosphoric acid,	6.93	8.22
Potassium oxide,	.94	1.20
Nitrogen (in organic matter),	.87	1.48
Nitrogen (in ammonia salts),	.14	.26
Nitrogen (in nitrates),	.64	1.00
Valuation per 2,000 lbs.,	$24 00	$34 49

Bat Guanos.

	Pounds per Hundred.			
	I.	II.	III.	IV.
Moisture,	25.47	61.90	72.38	7.80
Organic and volatile matter,	90.00	90.13	95.66	27.85
Ash constituents,	10.00	9.87	4.34	72.15
Total phosphoric acid,	4.43	2.28	1.00	2.04
Nitrogen (in organic matter),	5.66	2.21	2.32	.34
Nitrogen (in ammonia salts),	3.42	1.49	–	–
Nitrogen (in nitrates),	1.80	1.13	.34	.24
Potassium oxide,	1.31	–	–	–
Insoluble matter,	1.45	3.69	1.91	54.15
Valuation per 2,000 lbs.,	$48 34	$21 33	$10 80	$4 53

Fish Fertilizers.

[Sent on for examination from Danvers, Mass.]

[I. Claimed to be chemically prepared fish.] [II. Claimed to be clear fish waste.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	7.70	9.00
Total phosphoric acid,	8.15	11.72
Soluble phosphoric acid,	.67	–
Reverted phosphoric acid,	3.19	4.41
Insoluble phosphoric acid,	4.29	7.31
Potassium oxide,	.89	–
Nitrogen (in organic matter),	8.13	8.16
Insoluble matter,	14.65	3.70
Valuation per 2,000 lbs.,	$45 51	$49 35

Special Corn Mixture.

[Sent on by Gould & Co., Medfield, Mass.]

	Pounds per Hundred
Moisture at 100° C.,	7.82
Ash,	72.25
Total phosphoric acid,	18.09
Soluble phosphoric acid,	1.22
Reverted phosphoric acid,	1.61
Insoluble phosphoric acid,	15.26
Potassium oxide,	2.78
Nitrogen,	2.38
Insoluble matter,	8.40
Valuation per 2,000 lbs.,	$30 75

Garden Fertilizer.

[Sent on by farmers from Somerset, Mass.]

	Per cent.
Moisture at 100° C.,	6.64
Soluble phosphoric acid,	.70
Reverted phosphoric acid,	2.12
Insoluble phosphoric acid,	8.26
Total phosphoric acid,	11.08
Potassium oxide,	11.42
Nitrogen,	4.28
Insoluble matter,	.90
Valuation per 2,000 lbs.,	$39 49

Fertilizer.

[Sent on by F. J. Kinney, for the farmers near Worcester, Mass.]

	Pounds per Hundred.
Moisture at 100° C.,	7.15
Organic matter,	53.05
Ash,	46.95
Total phosphoric acid,	14.00
Soluble phosphoric acid,	11.26
Reverted phosphoric acid,	2.38
Insoluble phosphoric acid,	.36
Potassium oxide,	1.13
Nitrogen,	2.56
Insoluble matter,	.83
Valuation per 2,000 lbs.,	$38 17

Tobacco Fertilizer.

[Sent on by D. H. Dickinson, Hadley, Mass., through the Secretary of Hampshire, Franklin and Hampden Agricultural Society, Northampton, Mass.]

	Per cent.
Moisture at 100° C.,	14.65
Total phosphoric acid,	12.76
Soluble phosphoric acid,	2.97
Reverted phosphoric acid,	5.29
Insoluble phosphoric acid,	4.50
Nitrogen (total),	.77
Potassium oxide,	23.81
Sulphuric acid,	.89
Calcium oxide,	7.62
Carbonic acid,	3.20
Valuation per 2,000 lbs.,	$51 52

[I. Natural deposit from the West Indies. Sent on by "New England Homestead."]
[II. Fertilizer for French turnips. Sent on by "New England Homestead."]
[III. Fertilizer for round turnips. Sent on by "New England Homestead."]

	Pounds per Hundred.		
	I.	II.	III.
Moisture at 100° C.,	6.00	10.15	9.73
Total phosphoric acid,	29.53	7.35	6.50
Soluble phosphoric acid,	–	.86	.83
Reverted phosphoric acid,	10.28	2.59	2.29
Insoluble phosphoric acid,	19.25	3.90	3.38
Potassium oxide,	–	6.02	4.92
Nitrogen in organic matter,	–	2.28	2.24
Nitrogen in ammonia salts,	–	1.95	2.75
Total nitrogen,	–	4.23	4.99
Organic and volatile matter,	–	36.85	53.25
Ash,	–	63.15	46.75
Insoluble matter,	8.85	1.95	1.18
Valuation per 2,000 lbs.,	$35 83	$32 71	$34 06

Havana Tobacco Stems.

[Sent on by S. G. Hubbard, Hatfield, Mass.]

Moisture at 100° C.,	11.05
Dry matter,	88.95
Crude ash,	13.30
Nitrogen in dry matter,	2.91

One hundred parts of dry matter contained: —

Potassium oxide,	3.76
Sodium oxide,	.20
Calcium oxide,	4.15
Magnesium oxide,	1.53
Phosphoric acid,	.50
Sesquioxide iron,	.16
Valuation per ton of 2,000 lbs. for fertilizing purposes,	$14 28

The valuation is based on the prices of the past year (1883); it is safe to count one-tenth less at the prices of the present year.

Kentucky Tobacco Stems, Ground.

Moisture at 100° C.,	12.18
Dry matter,	87.82
Crude ash (in organic matter),	15.00
Nitrogen (in organic matter),	2.616
Chlorine,	.425
Sulphur,	.275
Potassium oxide (4½ cents),	8.816
Sodium oxide,	.161
Magnesium oxide,	1.395
Calcium oxide,	3.720
Phosphoric acid (6 cents),	.726
Insoluble matter,	1.618
Valuation per 2,000 lbs.,	$17 78

In this case the valuation is based upon prices current in 1884. Nitrogen has been valued at 18 cents per pound, phosphoric acid at 6 cents, and potash, 4¼ cents. Both of these refuse materials from the tobacco industry are quite valuable for manurial purposes.

Sumac. Waste Material from Tanneries in Peabody, Mass.

[Sent on for the Massachusetts Society for Promoting Agriculture.]

Moisture at 100° C.,	63.06
Organic matter,	36.94
Nitrogen in organic matter,	1.19
Crude ash in organic matter,	6.80
Calcium oxide in ash,	1.14
Magnesium oxide in ash,	3.25
Potassium oxide in ash,	.17
Phosphoric acid,	.17
Insoluble matter in ash,	2.25

The nitrogen, potash and phosphoric acid contained in the above article, represent a commercial value of $4.64 per ton of 2,000 pounds.

The tanning principle was so completely abstracted, that a composting with some air-slacked lime promises to render the material quite valuable as a manurial substance for light soils, deficient in organic matter.

Fresh Water Mud.

[Little Pond at South Braintree. Sent on by A. Drew, Esq., Boston, Mass.]

Analysis of a fairly dried sample:—

Moisture at 100° C.,	40.37
Calcium oxide,	1.27
Magnesium oxide,	.29
Potassium oxide,	.22
Ferric oxide,	1.80
Phosphoric acid,	.26
Nitrogen,	1.37
Insoluble matter,	18.26

The material in its natural state contains 72 per cent. water; in its composition it resembles a fibrous peat, yet it is less humified, and will yield its nitrogen, etc., more readily. One ton of the analyzed material represents a commercial value of from $5 to $6.

Salt Mud.

[Sent on by L. B. Goodwin, So. Duxbury, Mass.]

[I. Sample taken from a dock dug in a salt marsh. The sender states that large quantities of kelp have been unloaded at this dock, and a good deal of eel-grass is also deposited.]

[II. Taken from the flats at low-water mark.]

	I.	II.
Moisture at 100° C.,	46.36	60.37
Ash constituents,	49.28	33.09
Insoluble in acids,	43.55	26.20
Nitrogen in organic matter,	.39	.40

Soluble constituents contained: —

	I.	II.
Sesquioxide of iron,	4.55	3.70
Calcium oxide,	.66	.90
Magnesium oxide,	.31	.43
Potassium oxide,	.33	.32
Sodium oxide,	.94	.94
Phosphoric acid,	traces.	traces.

Black Mud.

[III. From the flats near Weymouth, Mass. Sent on by Thomas A. Watson, Esq.]

Moisture at 100° C.,	56.55
Ash constituents,	39.60
Insoluble in acids,	31.84
Nitrogen in organic matter,	.30

Soluble constituents contained: —

Sesquioxide of iron,	4.26
Calcium oxide,	.91
Magnesium oxide,	.66
Potassium oxide,	.38
Sodium oxide,	.86
Phosphoric acid,	traces.

These three deposits of tidal water are of a similar composition. The amount of organic matter present does not exceed seven per cent., and the soluble mineral substances are mainly those found in the water of the ocean. The commercial value of plant constituents amounts, at present rates per ton of the deposits, in none of them to more than $1.75; in the last-named sample still less.

For those interested in the composition of the fertilizing material deposited and collected along the seashore, the following references are given: —

Kelp and Rockweed. See Report of State Board of Agriculture, 1878–79, page 347.

Rockweed and Musselmud. Report, 1879–80, page 338, 339.

Eel-grass. Report, 1882–83, page 407.

Analysis of Soil from a Diked Marsh at East Salisbury, Mass.

Moisture at 100° C.,	34.40
Organic and volatile matter,	92.15
Ash constituents,	7.85
Soluble part of ash,	4.20
Insoluble part of ash,	3.65
Nitrogen in organic matter,	1.64
Phosphoric acid in ash,	.13
Potassium oxide in ash,	.26
Calcium oxide,	1.24

ON EXAMINATION OF DRINKING-WATER.

One of the first requirements of success on a farm consists in ample supply of a good water. Purity of the water used, for drinking in particular, is of vital importance. Cities and towns usually have their organizations for the supply of water, and they exact certain guarantees regarding the quality furnished for their use. The farmer, living as a rule more isolated on his farm, is in this respect largely left to his own counsel. His chances for obtaining good water from springs, and for protecting his wells against the access of obnoxious matters by infiltrations and otherwise, are, in the majority of cases, quite favorable, if intelligently turned to account.

A satisfactory supply of a good drinking-water depends, in a controlling degree, on a judicious selection of the location of the well designed for the use of the family and for the live stock; and on the personal attention bestowed, from time to time, on the condition of the latter and its surroundings. Wells may be badly located in the start, or may become exposed to contamination by subsequent changes in the surroundings. Good wells are liable to change for the worse at any time, on account of circumstances too numerous to state in this connection. To periodically ascertain the exact condition of the well which supplies the wants of the family and of the live stock, is a task which no farmer can for any length of time discard, without incurring a serious risk in health and prosperity. The subject receives, quite frequently, but little attention, on account of the fact that the harmful qualities, which an apparently good water may contain, are disguised, beyond recognition by the unaided senses. Certain delicate chemical tests, aided at times by microscopical observations, are, in the majority of cases,

the only reliable means, in our present state of the sciences, by which desirable information regarding the true character of a drinking-water can be obtained.

These tests, it must be acknowledged, although of the greatest importance from a general standpoint, have their limitations. They readily indicate the presence of organic matters, but give no unfailing decision regarding their origin, — whether animal or vegetable, — leaving thus, quite frequently, the degree of their harmfulness quite undecided. However, the chemical analysis may be depended upon for all practical purposes, as revealing the presence of objectionable qualities of the water.

The harmful substances found in drinking-water are of two classes, — mineral and organic. Few natural waters are entirely free from mineral matters; nearly all contain small quantities of lime, soda, magnesia and iron, — substances which may be considered harmless in that case. Larger quantities of these elements, however, render the water objectionable for drinking, and also more or less unfit for various applications, as washing and cooking, feeding of steam apparatus, etc.

Foremost among the dangerous mineral substances which have been found in drinking-water is the lead. Its presence is usually due to the use of lead pipes for conducting the water from the well to the pump, and elsewhere. Lead is a treacherous and dangerous poison. Not a trace should be tolerated in drinking-water. The use of lead pipes for conducting the latter for either of the above stated purposes should be strictly prohibited by State law. Arsenic and copper are rarely met with in natural waters; yet a careless handling of paris green is at any time apt to become most dangerous in this direction.

These three metals — lead, copper and arsenic — are direct poisons to the animal system, and therefore are the most dangerous mineral impurities in drinking-water, though ordinarily rare.

The most frequent source of danger comes evidently from the presence of organic matter, indicating contamination by decaying animal or vegetable substances. Wells are not infrequently found polluted by the gases and liquids emanat-

ing from sinks, privies, cesspools or barnyards, when apparent conditions would seem to render it impossible.

Much has been written on this subject, yet the necessity for constant warning still remains. No better illustration is needed than the analyses of the samples given below, which were taken, almost at random, in various parts of the State. These analyses have been made according to Wancklyn's process, familiar to chemists, and are directed toward the indication of the presence of chlorine, free and albuminoid ammonia, and the poisonous metals. (For a more detailed description of this method, see Water Analysis, by J. A. Wancklyn and E. T. Chapman.)

The hardness was determined by Frankland's method. (See Frankland's Water Analysis, page 29.)

The presence of chlorine indicates contamination from sinks, privies or sewers, since it occurs abundantly in urinary secretions; but it may be derived from other and less harmful sources, as saline waters, which the test fails to indicate. One conclusion is, however, safe: a water which contains no chlorine is uncontaminated by sewerage. "Free" and "albuminoid" ammonia are the forms in which organic matter is recognized. Ammonia, existing as such in water, is termed "free." This being expelled by distillation, the nitrogen containing organic matter remaining is reduced to ammonia by chemical agencies, and this secondary product is called "albuminoid ammonia."

The per cent. of total solids is obtained by evaporating a known quantity of the sample to dryness and weighing the residue.

Hardness, a rather arbitrary term, signifies that quality of water which prevents the ready formation of lather with soap. It is usually due to the presence of salts of lime or magnesia, which decompose the soap, forming new insoluble compounds. As long as these reactions occur no lather will be formed, consequently the quantity of a standard soap consumed before a permanent lather is obtained, indicates the amount of earthy salts contained in the sample, or its relative degree of hardness. Frankland's scale has been changed to Clark's, the latter being a more popular one.

Ten degrees of Frankland's scale are equivalent to seven of Clark's.

Mr. Wancklyn's interpretation of the results of his mode of investigation are as follows:—

1st. Chlorine *alone* does not necessarily indicate the presence of filthy water.

2d. Free and albuminoid ammonia in water without chlorine indicates a vegetable source of contamination.

3d. More than five grains per gallon of chlorine, accompanied by more than 0.08 parts per million of free ammonia and more than one-tenth parts per million of albuminoid ammonia is a clear indication that the water is contaminated with sewage, decaying animal matter, urine, etc., and should be condemned.

4th. Eight one-hundredths parts per million of free ammonia and one-tenth parts per million of albuminoid ammonia render a water very suspicious, even without much chlorine.

5th. Albuminoid ammonia, over 0.15 parts per million, ought to condemn the water which contains it absolutely.

6th. The total solids found in the water should not exceed forty grains per gallon.

An examination of the subsequent results of analysis shows that one-half of the samples should be condemned.

ANALYSES OF DRINKING-WATER.

	Results in Parts per Million and Grains per Gallon (Imperial.)					Results Expressed in Parts per 100,000.				
	Parts per Million.		Grains per Gallon.							
	Free Ammonia.	Albumonoid Ammonia.	Chorine.	Solids.	Hardness. (Clark's Degrees.)	Free Ammonia.	Albuminoid Ammonia.	Chlorine.	Solids.	Hardness.
Sample No. I.,	.02	.10	.2	Not det.	.89	.002	.01	.287	Not det.	1.27
No. II.,	.60	.48	Not det.	"	Not det.	.06	.048	Not det.	"	Not det.
No. III.,	.06	.26	"	"	"	.006	.026	"	"	"
No. IV.,	-	.14	2.30	"	2.46	-	.014	3.290	"	3.515
No. V.,	.03	.14	.50	"	Not det.	.003	.014	.714	"	Not det.
No. VI.,	2.41	.05	3.20	"	4.90	.241	.005	4.571	"	7.000
No. VII.,	1.51	.37	1.70	13.50	2.28	.151	.037	2.429	19.286	3.257
No. VIII,	.03	.16	.30	5.75	1.82	.003	.016	.429	8.214	2.600
No. IX.,	29.10	2.20	9.40	Not det.	Not det.	2.91	.220	13.429	Not det.	Not det.
No. X.,	3.20	.40	3.75	"	"	.320	.040	5.357	"	"
No. XI.,	.11	.16	.50	"	1.37	.011	.016	.714	"	1.957
No. XII.,	.01	.37	4.45	25.50	10.39	.001	.037	6.357	36.429	14.843
No. XIII.,	46.87	1.07	5.40	33.50	7.70	4.687	.107	7.710	47.857	11.000

No. XIV., ...	.04	.21	.60	Not det.	3.00	.004	.021	.857	Not det.	4.286
No. XV., ...	.06	.08	.60	3.00	1.73	.006	.008	.857	4.286	2.471
No. XVI., ...	.11	·15	2.70	Not det.	3.70	.011	.015	3.857	Not det.	5.287
No. XVII., ...	·72	.30	8.90	"	Not det.	.72	.030	12.714	"	Not det.
No. XVIII., ...	.10	.11	Not det.	13.00	2.73	.010	.011	Not det.	18.571	3.90
No. XIX., ...	.07	.30	4.00	24.00	5.00	.007	.030	5.714	34.286	7.143
No. XX., ...	.06	.15	1.70	5.41	2.91	.006	.015	2.429	7.729	4.157
No. XXI., ...	.05	.11	1.70	22.50	7.74	.005	.011	2.429	32.143	11.057
No. XXII., ...	.21	.20	1.30	9.00	2.55	.021	.020	1.857	12.857	3.643
No. XXIII., ...	.66	.36	7.50	60.00	13.00	.066	.036	10.714	85.714	14.571
No. XXIV., ...	.50	.36	14.50	83.00	16.50	.050	.036	20.714	118.571	23.571
No. XXV., ...	.34	.16	12.90	52.00	11.80	.034	.016	18.429	74.286	16.857
No. XXVI., ...	.01	.07	.70	Not det.	2.50	.001	.007	1.000	Not det.	3.571

METEOROLOGY.

The importance of meteorological data in connection with observations upon plants or animals is apparent to all. No conclusions based on such observations are firmly grounded until the conditions of temperature, moisture and sunlight have been duly considered. The weather, therefore, constitutes an important factor in all experiments with animal or vegetable organisms.

To supply these useful and necessary facts the station has provided itself with the ordinary meteorological instruments for measuring temperature, rainfall, relative humidity of the air, etc., uniform with those in use by the United States Signal Service. These comprise an ordinary exposed thermometer, hygrometer, maximum and minimum self-registering thermometers, and rain and snow gauges. The thermometers are of high, standard quality, of which the names of the makers — Messrs. J. & J. H. Green of New York, — are sufficient guarantee. These are placed in a small thermometer house, specially constructed for the purpose, with sides of open shutters, five feet above the surface of the ground, and at sufficient distance from any buildings or trees to allow free exposure toward all points of the compass.

Three times daily, at 7 A. M., 2 P. M., and 9 P. M., the temperature and relative humidity of the air, amount and direction of clouds, direction and force of wind, state of the weather, and amount of rain, if any has fallen, are recorded. In addition to these observations, the maximum and minimum temperatures for the previous twenty-four hours are recorded at 9 P. M. These tri-daily observations give a very complete record of meteorological phenomena.

The station has become a "voluntary observer" in cooperation with the Signal Service, and forwards to that deparment a duplicate record of observations for each month, receiving in return its Farmer's Daily Weather Bulletin, and publications. The bulletins are posted in a conspicuous

place for the benefit of all who may choose to examine them, and upon the receipt of warning from the Central Signal Service Station of this district, a cold wave flag is displayed above the Station buildings. This method of forewarning the public of the approach of serious changes of temperature is easily understood and appreciated, and will, we believe, be of much local value in the spring and fall months.

A meteorological summary for Amherst, for 1884, is presented here, through the courtesy of Miss S. C. Snell, observer at Amherst College. It will serve a general purpose sufficiently well, though taken at a location and exposure differing from those of the Station by so much that appreciable differences in rainfall and extremes of temperature undoubtedly exist. A record of the rainfall at the Station for a part of the year bears out this supposition, as the following comparison shows :—

MONTH.	Rain at Amherst College.	Rain at Experiment Station.
	Inches.	*Inches.*
May,	2.02	2.02
June,	1.38	2 11
July,	3.75	3.98*
August,	5.10	4.21
September,	1.25	1.04
October,	2.40	2.06
November,	2.53	2.62
December,	–	–
Total for eight months,	–	–

Although the two places of observation are only about one mile apart, the monthly rainfall agreed in only one case, and in one instance (August) differed 0.89 of an inch.

This comparative record, incomplete as it is, strongly emphasizes the necessity of obtaining meteorological data in the immediate locality of the scene of the experiments.

Records from even an adjoining neighborhood do not answer the requirements at all, and this is especially true in a hilly, broken country like that surrounding Amherst.

The instruments above mentioned will therefore prove an important addition to our resources.

* Incomplete.

METEOROLOGICAL SUMMARY FOR AMHERST, MASS., 1884.

[From the Records of Miss S. C. Snell.]

MONTH.	Temperature.			Winds. Percentage from each quarter.				Relative Humidity.			Rain and Melted Snow.	Snow.
	Mean.	Maximum.	Minimum.	N.W. to W.	S. W. to S.	S. E. to E.	N. E. to N.	Mean.	Maximum.	Minimum.	Inches.	Inches.
January,	21.64	40.1	8.0	47	35	15	3	72	100	41	3.598	2.0
February,	30.86	46.0	5.1	39	20	30	11	77	100	22	4.623	9.5
March,	32.89	54.0	–	48	24	15	13	70	100	34	5.669	4.0
April,	46.69	70.3	31.2	43	18	14	25	63	93	22	2.481	10.0
May,	57.35	85.2	37.6	52	22	18	8	65	90	13	2.020	–
June,	69.10	92.5	50.0	27	36	35	2	69	95	27	1.383	–
July,	68.64	93.0	57.1	53	19	22	6	75	97	40	3.746	–
August,	69.25	92.4	48.8	40	25	32	3	79	–	–	5.095	–
September,	64.35	90.0	39.0	31	39	27	3	77	97	40	1.253	–
October,	50.27	78.2	26.5	48	26	15	11	74	97	33	2.395	–
November,	38.43	61.0	19.8	53	27	17	3	71	95	29	2.530	0.5
December,	30.00	57.0	10.0	53	14	21	6	40	100	–	5.576	11.5

ABSTRACT FROM THE WEATHER RECORD OF PROF. E. S. SNELL, OF AMHERST COLLEGE, AMHERST, MASS., 1836 TO 1885.

MONTHS.	1836.*		1837.*		1838.*		1839.*		1840.†	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	–	4.21	20.26	1.75	31.99	2.45	24.56	1.66	14.45	3.15
February,	–	3.83	26.69	2.42	19.55	1.67	29.79	1.75	28.50	2.03
March,	32.68	3.13	33.70	2.65	36.35	1.69	37.54	1.69	34.97	3.18
April,	47.27	1.98	47.42	4.33	40.72	2.02	52.18	4.14	48.95	3.98
May,	61.36	2.59	57.88	5.76	54.32	3.63	60.71	3.49	57.06	1.91
June,	66.37	3.45	68.15	4.49	68.63	4.90	65.40	3.30	65.50	4.60
July,	73.62	6.02	70.64	7.35	71.86	2.27	74.40	9.56	70.56	3.34
August,	68.00	0.96	68.61	2.57	68.16	3.95	70.74	2.51	70.26	6.82
September,	62.36	2.28	61.42	1.07	62.73	6.38	63.50	2.82	57.22	5.20
October,	47.88	3.02	49.97	2.06	46.53	4.12	53.32	1.78	47.39	5.04
November,	38.22	3.49	40.23	1.90	34.07	5.77	36.65	3.04	36.95	4 61
December,	29.24	5.80	27.62	2.35	23.52	0.96	28.93	7.09	23.61	3.15
Means and sums,	52.70	40.76	47.72	38.70	46.52	39.81	49.81	42.83	46.28	47.01

* Observations taken, for average temperature, at 9 o'clock, A. M. and 3 o'clock, P. M.

† Observations of average temperature taken at 7 o'clock, A. M. and 6 o'clock, P. M.

Abstract from the Weather Record — Continued.

MONTHS.	1841.*		1842.*		1843.*		1844.*		1845.†	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	25.63	5.80	25.55	1.02	29.73	1.99	13.93	3.44	24.52	4.97
February,	20.20	1.50	30.50	3.78	16.48	3.49	22.07	2.18	24.86	3.37
March,	31.90	2.85	37.69	2.39	24.52	5.73	35.53	4.12	36.93	3.56
April,	41.63	4.52	46.50	2.92	44.63	4.82	51.95	0.57	45.59	1.70
May,	54.39	3.47	52.71	2.40	55.95	2.09	57.85	5.59	56.15	2.42
June,	68.35	1.65	64.10	3.18	65.28	5.18	65.55	3.00	66.71	2.57
July,	69.53	2.55	71.48	1.95	68.76	2.53	68.23	3.81	72.12	3.31
August,	69.82	3.18	69.05	7.42	69.81	9.38	68.00	4.93	71.54	2.79
September,	61.21	3.50	57.43	3.23	61.70	1.57	59.55	1.84	58.30	2.58
October,	42.81	3.73	47.44	2.84	44.98	9.45	47.55	6.49	49.64	4.66
November,	35.28	2.80	35.10	3.73	33.98	3.07	35.73	2.12	41.49	3.90
December,	29.50	6.08	24.18	3.19	27.97	2.28	27.28	2.49	21.53	3.91
Means and sums,	45.85	41.63	46.81	38.05	45.32	51.58	45.94	40.58	47.45	39.74

* Observations in temperature taken at 7 o'clock, A. M. and 6 o'clock, P. M.

† Observations in temperature taken at 7, 8 or 9 o'clock, A. M. and 6 o'clock, P. M.

Abstract from the Weather Record — Continued.

MONTHS.	1846.*		1847.*		1848.*		1849.*		1850.*	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain Inches.
January,	24.75	2.74	25.50	4.86	28.95	2.92	20.02	0.99	25.90	4.75
February,	20.14	2.55	24.71	4.88	23.71	2.60	18.50	0.99	28.42	3.56
March,	36.33	4.35	29.24	3.57	32.63	3.03	35.37	4.21	32.43	1.86
April,	50.06	1.54	43.28	1.41	43.32	1.55	43.49	2.24	42.91	3.93
May,	58.29	4.33	57.48	1.91	59.47	6.18	53.42	3.61	53.38	8.72
June,	64.96	3.10	64.73	4.44	67.63	2.58	66.88	1.53	67.27	2.88
July,	70.66	3.25	72.42	4.48	69.45	4.72	72.09	2.25	72.08	6.81
August,	69.60	2.44	69.27	4.06	70.56	1.53	68.85	7.86	67.10	6.50
September,	65.48	0.47	59.30	3.63	57.43	2.49	60.05	1.40	59.40	4.93
October,	47.59	2.09	45.97	3.99	47.31	3.15	47.03	6.36	48.18	3.65
November,	43.05	4.96	43.15	4.17	33.49	3.09	44.08	3.65	39.95	2.63
December,	25.32	3.10	34.24	6.41	30.56	5.54	28.40	3.36	23.45	5.37
Means and sums,	48.02	34.92	47.44	47.81	47.04	39.38	46.52	38.45	46.71	55.50

* Observations in temperature taken at 7, 8 or 9 o'clock, A.M., and 6 o'clock, P.M.

Abstract from the Weather Record — Continued.

MONTHS.	1851.*		1852.†		1853.†		1854.‡		1855.‡	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	23.79	1.66	19.57	2.415	24.26	2.107	22.75	2.007	27.26	5.061
February,	27.89	5.08	25.17	3.349	26.72	6.686	21.96	4.530	19.83	2.702
March,	35.51	1.28	30.86	3.256	33.82	2.391	31.62	3.105	31.53	1.078
April,	46.20	4.43	39.44	4.711	44.02	3.786	43.47	8.328	43.83	3.845
May,	55.61	4.07	56.05	2.295	56.70	5.404	59.49	3.193	56.65	1.492
June,	63.60	3.69	65.38	2.544	66.97	2.636	66.67	1.751	65.04	5.191
July,	69.13	4.31	69.95	3.381	68.73	3.585	74.08	3.525	70.87	6.102
August,	66.20	3.03	65.16	5.190	67.84	7.126	68.82	0.988	65.53	2.553
September,	60.93	2.05	58.37	2.475	59.54	5.664	61.50	5.458	60.82	0.547
October,	51.04	5.43	49.31	1.763	46.84	3.747	51.53	2.305	49.73	10.078
November,	34.54	5.30	36.42	6.426	39.14	6.238	40.27	7.480	38.84	4.123
December,	20.13	3.17	32.85	4.876	26.31	1.834	22.29	2.390	28.21	5.409
Means and sums,	46.21	43.50	45.71	42.681	46.65	48.240	46.99	45.560	46.52	48.181

* Observations in temperature taken at 7, 8 or 9 o'clock, A.M., and 6 o'clock, P.M.
† Observations in temperature taken at 6 o'clock, A.M., and 2 and 10 o'clock, P.M.
‡ Observations in temperature taken at 7 o'clock, A.M., and 2 and 9 o'clock, P.M.

Abstract from the Weather Record — Continued.

MONTHS.	1856.*		1857.*		1858.*		1859.*		1860.*	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	15.24	2.483	13.54	3.547	28.81	3.519	22.94	4.887	26.52	1.210
February,	19.02	0.788	31.42	2.407	20.59	1.604	25.59	3.540	24.83	2.984
March,	25.88	1.118	31.08	2.121	31.31	0.795	36.74	6.272	37.19	1.582
April,	46.44	2.510	41.01	7.683	44.37	3.197	43.45	2.962	43.99	1.277
May,	53.58	5.313	55.19	6.818	54.10	2.981	59.19	4.076	57.29	4.573
June,	68.56	1.920	63.63	2.664	66.10	4.620	62.80	6.157	65.22	3.566
July,	72.93	1.955	70.87	4.982	69.80	6.726	67.73	2.607	66.39	6.125
August,	66.19	12.132	67.22	3.140	67.90	4.820	66.43	6.652	68.01	2.676
September,	60.79	3.472	59.90	3.039	50.90	4.135	57.10	4.466	56.78	6.115
October,	48.68	1.403	48.90	3.878	51.42	3.856	45.72	1.853	48.85	2.183
November,	37.47	2.847	39.46	2.069	33.91	2.158	41.07	2.960	42.70	3.521
December,	23.20	4.187	31.47	5.313	25.71	3.161	23.03	4.847	23.87	3.843
Means and sums,	44.84	40.128	46.14	47.661	45.40	41.572	45.98	51.279	46.80	39.655

* Observations in temperature taken at 7 o'clock, A. M., and 2 and 9 o'clock, P. M.

Abstract from the Weather Record — Continued.

MONTHS.	1861.*		1862.*		1863.*		1864.*		1865.*	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	20.45	4.342	22.31	5.253	29.08	5.053	24.36	2.200	18.73	3.483
February,	29.22	3.284	22.10	2.840	26.29	4.433	28.49	1.115	25.03	2.880
March,	32.49	3.759	32.17	4.298	26.13	5.602	34.40	2.578	37.12	5.980
April,	45.50	5.651	43.55	2.276	45.48	2.329	43.54	2.570	49.01	2.901
May,	53.37	4.449	58.13	2.325	55.35	3.587	60.41	2.541	57.13	7.892
June,	65.48	2.694	63.39	11.687	59.03	4.086	65.70	1.376	69.29	2.939
July,	69.46	5.229	67.98	5.117	70.87	8.636	71.49	0.964	69.06	3.719
August,	65.67	4.102	68.11	2.957	70.07	6.114	70.82	4.401	68.58	1.864
September,	59.93	2.751	61.06	2.118	57.38	2.163	57.84	2.924	65.62	0.373
October,	51.52	4.527	50.96	3.277	49.90	4.035	46.37	2.938	45.97	4.980
November,	37.82	3.981	39.56	4.757	41.06	5.278	38.04	6.197	39.91	2.453
December,	29.00	2.165	27.55	1.911	25.34	4.867	30.18	4.629	28.92	3.536
Means and sums,	46.66	46.934	46.41	48.816	46.33	56.183	47.64	34.433	47.86	42.980

* Observations in temperature taken at 7 o'clock, A. M., and 2 and 9 o'clock, P. M.

Abstract from the Weather Record — Continued.

MONTHS.	1866.*		1867.*		1868.*		1869.*		1870.*	
	Temp. F.	Rain Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	21.93	1.363	18.30	1.324	20.21	3.519	28.04	3.467	30.78	5.872
February,	26.18	4.617	31.23	3.646	18.21	1.030	28.01	4.137	25.34	5.247
March,	31.64	3.157	30.84	3.115	33.80	3.249	27.28	5.455	30.88	2.709
April,	48.63	2.031	45.49	3.791	41.96	4.270	46.45	1.532	48.26	3.701
May,	54.63	4.480	54.05	4.610	55.13	7.863	55.87	5.649	58.27	1.723
June,	65.82	5.660	67.06	5.672	66.17	2.441	64.72	5.986	70.45	2.728
July,	72.91	4.020	68.14	4.000	73.97	3.284	69.08	2.978	73.55	2.526
August,	63.48	3.955	68.56	9.161	68.97	5.665	66.87	1.039	71.11	2.828
September,	60.00	4.713	59.99	1.107	59.47	10.633	62.06	4.318	62.32	1.752
October,	49.50	3.381	49.90	3.845	45.30	1.371	46.68	11.358	52.02	4.494
November,	40.10	3.859	37.87	4.305	36.48	4.796	35.92	2.591	39.10	3.278
December,	26.30	3.572	22.64	1.511	22.82	1.471	27.48	4.958	28.00	1.840
Means and sums,	46.76	44.808	46.17	46.087	45.21	48.590	46.54	53.466	49.17	38.698

* Observations in temperature taken at 7 o'clock, A. M., and 2 and 9 o'clock, P. M.

Abstract from the Weather Record — Continued.

MONTHS.	1871.*		1872.*		1873.*		1874.*		1875.*	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	23.27	1.960	25.11	1.507	20.56	5.013	28.15	5.461	16.73	2.896
February,	25.95	2.907	24.16	1.888	24.00	2.174	24.48	2.185	17.53	3.620
March,	40.53	3.988	25.27	2.870	30.64	3.176	32.93	1.348	27.79	4.200
April,	48.00	3.087	45.03	2.201	43.23	1.738	38.32	6.028	40.80	3.329
May,	57.84	3.815	59.14	3.110	54.58	3.910	56.52	5.224	57.14	2.188
June,	65.38	6.575	68.14	3.250	67.48	1.592	66.18	5.059	65.84	2.888
July,	69.18	3.523	72.64	7.066	71.30	2.927	67.16	11.579	69.30	8.149
August,	68.87	6.453	71.60	5.280	67.01	3.468	65.58	2.689	68.94	6.165
September,	52.84	1.302	61.70	6.197	60.35	4.765	62.03	1.818	57.27	4.649
October,	50.95	6.089	48.24	3.639	49.93	6.357	47.60	1.845	47.90	3.887
November,	34.03	3.507	36.43	4.483	29.68	3.509	36.21	3.536	33.11	3.974
December,	24.62	2.668	19.50	2.691	29.23	3.308	29.29	1.168	28.26	1.032
Means and sums,	46.79	45.874	46.41	44.182	45.67	41.937	46.21	47.940	44.22	46.977

* Observations in temperature taken at 7 o'clock, A. M., and 2 and 9 o'clock, P. M.

Abstract from the Weather Record — Continued.

MONTHS.	1876.*		1877.*		1878.*		1879.*		1880.*	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Rain. Inches.	Temp. F.
January,	29.85	2.305	20.05	2.517	25.29	3.575	21.55	1.748	31.60	4.583
February,	26.36	5.526	30.78	0.360	27.14	3.665	22.37	3.490	29.09	3.600
March,	31.60	7.140	33.30	6.973	39.24	2.565	33.00	4.975	33.46	2.680
April,	43.60	3.105	47.80	2.452	52.17	5.853	43.18	3.847	47.54	2.640
May,	57.50	3.956	58.50	1.925	57.38	2.360	60.60	3.317	64.15	1.903
June,	70.61	3.867	67.77	4.587	64.73	6.003	66.26	5.365	68.52	1.401
July,	74.19	4.836	71.13	6.470	73.33	2.163	71.00	5.745	71.81	6.340
August,	70.54	0.272	71.35	2.790	68.63	6.974	67.19	5.885	67.53	2.908
September,	59.10	3.705	63.31	0.910	63.20	2.821	59.02	2.590	63.24	2.686
October,	45.50	1.118	50.50	6.985	54.43	2.054	56.01	1.800	47.27	2.269
November,	40.50	2.488	41.92	5.435	39.11	5.339	37.37	2.350	34.91	2.495
December,	19.70	3.217	33.09	1.023	28.95	6.020	30.83	4.848	22.79	2.287
Means-and sums,	47.42	41.499	49.12	42.417	49.47	49.392	47.36	45.960	48.49	35.792

* Observations in temperature taken at 7 o'clock, A. M., and 2 and 9 o'clock, P. M.

Abstract from the Weather Record — Concluded.

MONTHS.	1881.*		1882.*		1883.*		1884.*	
	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.	Temp. F.	Rain. Inches.
January,	17.92	4.011	23.57	5.436	21.00	3.243	21.64	3.598
February,	24.86	1.771	28.19	4.233	25.02	4.027	30.86	4.623
March,	36.20	4.859	35.13	5.200	27.26	1.700	32.89	5.669
April,	43.65	1.645	44.31	1.518	44.29	2.184	46.69	2.481
May,	61.70	4.281	52.86	6.498	58.60	6.195	57.35	2.020
June,	62.77	3.945	66.85	2.251	69.72	3.987	69.00	1.383
July,	70.64	1.501	71.89	1.829	70.42	3.691	68.64	3.746
August,	70.49	2.758	70.89	0.250	66.39	1.573	69.25	5.095
September,	67.35	2.368	63.23	11.846	59.43	3.174	64.35	1.253
October,	52.47	4.239	52.72	1.673	46.82	4.308	50.27	2.395
November,	40.30	4.578	36.45	1.330	40.43	1.800	38.43	2.530
December,	36.01	6.148	26.65	1.470	27.02	2.993	30.00	5.576
Means and sums,	48.70	42.104	47.73	43.534	46.36	38.875	48.29	20.369

Average yearly temperature from 1836 to 1884 inclusive, 46.578° F. Average yearly rainfall for same period, 43.532 inches.

* Observations in temperature taken at 7 o'clock, A. M., and 2 and 9 o'clock, P. M.

ABSTRACT FROM THE PREVIOUS RECORDS,

PREPARED FOR SHORTER PERIODS OF THE YEAR, WHICH ARE OF SPECIAL INTEREST TO AGRICULTURISTS OF THE STATE; I. E., FROM THE 15TH OF APRIL TO THE 15TH OF JUNE, AND FROM THE 15TH OF AUGUST TO THE 15TH OF OCTOBER.

Averages of Temperature at 9 A. M and 3 P. M.

YEAR.	Last 15 Days of April.	First 16 Days of May.	Last 15 Days of May.	First 15 Days of June.	Last 15 Days of Aug.	First 15 Days of Sept.	Last 15 Days of Sept.	First 15 Days of Oct.
1836,	51.6°	61.9°	59.8°	67.6°	6.74°	63.3°	61.5°	48.9°
1837,	50.3	55.1	60.8	68.5	66.9	63.8	58.9	50.3
1838,	44.2	54.3	64.0	76.7	70.9	66.5	63.0	55.4
1839,	54.1	57.9	63.3	62.7	71.0	66.3	58.7	54.9
Averages of Temperature at 7 o'clock A M. and 6 P. M.								
1840,	53.93	50.8	63.8	62.8	71.3	60.3	54.1	51.3
1841,	46.2	47.6	62.0	67.1	68 2	66.1	60.5	45.5
1842,	49.4	48.8	59.5	60.8	69.7	63.5	51.7	51.2
Averages of 7 A. M. and 3 and 6 P. M.						*Averages of 8 A. M. and 3and 6 P M.*		
1843,	52.1	57.5	62.6	63.2	72.6	64.7	63.6	49.7
1844,	56.2	60.2	61.3	62.9	68.7	67.6	58.2	51.6
1845,	52.1	61.7	58.0	70.7	73.4	63.5	58.8	58.6
1846,	58.3	60.9	59.5	69.9	68.3	74.3	61.9	56.9
1847,	51.4	57.9	63.2	64.7	69.7	66.4	56.9	49.4
1848,	49.3	58.4	66.0	63.6	69.6	64.8	55.4	51.3
1849,	46.2	52.5	59.8	65.1	71.8	62.9	59.3	47.9
1850,	48.4	53.8	53.7	68.2	66.8	65.6	58.5	51.9
1851,	46.3	55.7	64.2	64.1	67.4	70.7	58.2	58.3
Averages of Temperature at 6 A. M. and 2 and 10 P. M.								
1852,	46.1	53.8	59.3	62.3	70.5	62.9	53.2	52.2
1853,	50.3	52.2	61.5	64.9	63.0	64.2	54.5	46.5

Abstract from the Previous Records — Continued.

Averages of Temperature at 7 A. M. and 2 and 9 P. M.

YEAR.	Last 15 Days of April.	First 16 Days of May.	Last 15 Days of May.	First 15 Days of June.	Last 15 Days of Aug.	First 15 Days of Sept.	Last 15 Days of Sept.	First 15 Days of Oct.
1854,	46.3	57.3	61.9	66.2	68.1	64.7	54.2	55.1
1855,	49.7	55.2	58.5	60.9	62.8	63.2	58.4	57.3
1856,	51.6	49.7	57.9	64.6	62.2	63.0	58.6	52.4
1857,	41.2	52.7	57.9	62.2	64.4	65.9	53.9	53.6
1858,	42.2	55.3	52.9	64.2	–	66.2	54.8	52.7
1859,	41.7	58.2	60.1	59.5	63.2	57.2	57.0	52.6
1860,	43.3	58.7	59.1	64.0	71.3	58.8	54.7	46.5
1861,	49.2	51.3	55.6	64.4	60.8	60.9	60.9	55.2
1862,	49.2	55.9	60.5	62.9	64.6	62.8	59.3	56.2
1863,	49.4	53.9	63.2	61.8	66.3	62.9	53.8	52.1
1864,	47.4	58.8	62.1	61.8	66.1	57.9	57.8	48.8
1865,	51.1	54.5	59.9	67.6	65.0	71.3	60.2	52.2
1866,	52.4	54.4	54.9	62.1	61.6	63.3	56.7	50.3
1867,	47.9	50.9	57.3	65.8	66.9	61.9	57.2	49.6
1868,	48.2	51.6	58.9	63.3	68.8	65.9	53.1	50.5
1869,	54.7	53.8	58.0	62.4	68.0	63.1	61.0	54.3
1870,	49.9	56.4	60.2	67.9	68.9	62.0	61.9	55.6
1871,	48.7	54.2	64.6	67.4	67.4	58.9	52.1	55.5
1872,	49.7	58.9	59.4	63.8	69.9	62.9	60.4	49.7
1873,	45.0	51.1	60.9	64.4	64.6	62.3	58.4	50.8
1874,	39.4	53.3	60.4	64 5	63.6	65.4	59.2	49.2
1875,	40.4	51.2	64.8	62.8	67.7	63.8	51.1	47.5
1876,	45.7	53.9	61.3	68.2	67.6	61.2	56.8	46.3
1877,	51.8	53.6	63.3	67.9	72.4	65.1	61.5	54.3
1878,	55.9	56.1	59.2	60.7	67.1	68.2	58.6	56.4
1879,	49.8	58.5	62.7	65.7	65.5	63.8	54.2	61.4
1880,	50.4	59.7	68.9	64 7	67.3	65.7	62.9	51.6
1881,	51.1	59.7	60.4	59.9	69.0	67.4	67.1	58.0
1882,	46.8	49.7	56.2	63.8	66.9	65.6	60.9	54.7
1883,	42.9	50.8	62.1	69.4	66.7	67.0	58.5	49.9
1884,	51.3	54.1	61.1	66 6	65.9	67.6	61.1	54.2

Abstract from the Previous Records — Continued.

RAIN.

YEAR.	Last 15 Days of April.	First 16 Days of May.	Last 15 Days of May.	First 15 Days of June.	Last 15 Days of Aug.	First 15 Days of Sept.	Last 15 Days of Sept.	First 15 Days of Oct.
1836,	0.73	1.01	1.58	0.62	0.37	1.08	1.08	2.16
1837,	0.18	3.58	2.18	1.51	0.38	0.31	0.76	0.75
1838,	1.16	2.45	1.18	2.60	1.06	3.57	2.81	1.64
1839,	0.37	2.53	0.96	1.62	1.03	1.03	1.79	1.69
1840,	3.10	1.49	0.42	3.54	2.74	0.88	3.90	1.26
1841,	2.49	1.65	1.82	0.30	1.78	0.63	2.89	3.60
1842,	1.46	0.92	1.48	1.22	4.87	2.99	0.24	1.13
1843,	1.45	1.37	0.72	2.41	6.60	1.18	0.39	6.91
1844,	0.53	2.02	3.57	1.17	3.28	0.34	1.50	3.37
1845,	1.42	0.42	2.00	1.93	1.95	1.48	1.10	4.66
1846,	1.35	2.67	1.66	0.22	1.03	0.14	0.33	1.10
1847,	1.14	0.77	1.14	1.85	1.24	3.18	0.47	0.67
1848,	0.40	4.53	1.65	0.71	1.26	1.15	1.44	2.21
1849,	1.76	1.75	1.75	0.69	1.63	0.08	1.34	4.62
1850,	2.03	5.18	3.54	1.50	3.43	3.68	1.25	0.91
1851,	2.62	2.66	1.41	1.84	2.14	0.68	1.37	1.59
1852,	1.14	2.26	0.04	1.17	4.14	1.69	0.78	1.08
1853,	1.29	2.79	2.58	0.24	3.89	2.18	3.49	–
1854,	7.42	0.98	2.21	0.83	0.51	4.44	1.02	1.90
1855,	1.45	0.92	0.57	3.01	1.67	–	0.55	7.18
1856,	1.57	3.42	1.89	0.69	3.74	1.47	2.00	0.33
1857,	4.68	3.70	3.12	1.03	2.38	0.73	2.31	0.30
1858,	1.90	1.65	1.23	3.27	–	3.51	0.62	1.89
1859,	1.51	1.40	2.68	2.37	2.01	0.57	3.82	1.53
1860,	0.50	0.16	4.41	1.50	0.63	4.28	1.83	1.81
1861,	3.21	3.52	0.92	2.16	0.35	1.68	1.07	1.41
1862,	1.83	1.76	0.56	6.19	0.47	1.99	0.13	1.56
1863,	1.46	3.27	0.21	3.98	4.12	0.10	1.98	2.11
1864,	1.12	1.73	0.81	1.38	1.30	0.74	1.79	2.05
1865,	0.49	2.59	4.30	1.38	0.33	0.14	0.23	2.04

Abstract from the Previous Records — Concluded.

YEAR.	Last 15 Days of April.	First 16 Days of May.	Last 15 Days of May.	First 15 Days of June.	Last 15 Days of Aug.	First 15 Days of Sept.	Last 15 Days of Sept.	First 15 Days of Oct.
1866,	1.54	1.12	3.38	2.94	1.38	1.28	3.43	0.07
1867,	2.80	2.56	2.05	2.72	1.15	0.52	0.59	2.32
1868,	1.59	3.64	4 23	1.62	0.65	5.53	5.10	0.67
1869,	0.96	3.48	2.17	0.82	0.11	1.18	2.95	10.04
1870,	2 71	1.07	0.66	1.13	1.90	0.25	1.51	1.97
1871,	2.28	3.53	0.28	2.88	5.12	0.73	0.57	5.13
1872,	0.33	1.24	1.82	1.63	3 48	1.01	5.19	1.48
1873,	0.55	3.13	0.78	0.34	2.30	1.63	3.14	3.30
1874,	4.51	1.62	3.61	1.59	1.90	0.08	1.74	1.78
1875,	1.10	1.66	0.33	1.38	2.66	0.81	3.84	1.44
1876,	0.52	2.09	1.27	3.43	0.27	0.61	3.10	0.67
1877,	1.92	1.12	0.81	3.02	0.35	-	0.91	4.93
1878,	4.19	1.48	0.88	2.47	1.62	2.28	0.54	0.33
1879,	2.86	1.47	1.85	2.79	4.65	2.21	0.38	-
1880,	2.28	0.37	1.53	1.16	1.72	1.70	0.98	-
1881,	0.59	0.95	3.33	2.01	0.97	1.13	0.14	1.43
1882,	0.89	2.67	3.83	0.76	-	3.81	8.04	0 73
1883,	0.55	1.38	4.81	2.33	1.57	0.44	2.73	1.95
1884,	0.95	1.09	0.93	0.58	4.69	0.38	0.88	0.50

RECORD OF FROSTS.

YEAR.	Last Frost in Spring.	First Frost in Autumn.	YEAR.	Last Frost in Spring.	First Frost in Autumn.
1836,	May 14,	Aug. 10. / Sept. 6.	1861,	May 29,	Oct. 21.
1837,	May 29,	Sept. 3.	1862,	May 25,	Sept. 3.
1838,	May 18,	Oct. 8.	1863,	May 16,	Sept. 23.
1839,	May 4,	Oct. 6.	1864,	May 2,	Sept. 16.
1840,	April 28,	Sept. 13.	1865,	May 13,	Oct. 3.
1841,	May 20,	Oct. 1.	1866,	May 15,	Sept. 16.
1842,	May 21,	Sept. 24.	1867,	May 13,	Sept. 15.
1843,	June 1, 2,	Sept. 13.	1868,	May 12,	Sept. 18.

Record of Frosts — Concluded.

YEAR.	Last Frost in Spring.	First Frost in Autumn.	YEAR.	Last Frost in Spring.	First Frost in Autumn.
1844, . .	May 22, 23,	Sept. 24.	1869, . .	May 23, .	Sept. 1.
1845, . .	May 31, .	Sept. 13.	1870, . .	May 2, .	Sept. 12.
1846, . .	May 22, .	Oct. 4.	1871, . .	May 25, .	Sept. 21.
1847, . .	May 17, .	Sept. 16.	1872, . .	May 4, .	Sept. 4.
1848, .	May 1, .	Sept. 27.	1873, . .	May 31, .	Sept. 15.
1849, . .	May 3, .	Sept. 3.	1874, . .	May 23, .	Oct. 5.
1850, . .	May 22, .	Sept. 30.	1875, .	May 18, .	Sept. 12.
1851, . .	May 8, .	Sept. 15.	1876, . .	May 23, *	Sept. 28.
1852, . .	May 3, .	Sept. 17.	1877, . .	–	Sept. 22.
1853, . .	May 2, .	Sept. 30.	1878, . .	–	–
1854, . .	May 7, .	Sept. 21.	1879, . .	May 22, .	Sept. 21.
1855, . .	May 28, .	Sept. 20.	1880, . .	May 15, .	Sept. 24.
1856, . .	May 6, .	Sept. 25.	1881, . .	–	–
1857, .	May 13, .	Sept. 7.	1882, . .	–	Oct. 4.
1858, . .	–	Sept. 25.	1883, .	–	Sept. 4.
1859, . .	May 16, .	Sept. 16.	1884, . .	May 29, .	Sept. 14.
1860, . .	April 27, .	Sept. 28.	–	–	–

* No frost 7 A. M. Temperature 41°.

	Last 15 days of April.	First 16 days of May.	Last 15 days of May.	First 15 days of June.	Last 15 days of Aug.	First 15 days of Sept.	Last 15 days of Sept.	First 15 days of Oct.
Average rainfall, .	1.73 in.	2.06 in.	1.86 in.	1.81 in.	2.02 in.	1.46 in.	1.84 in.	1.89 in.
Average temp., .	48.6°	57.0°	60.4°	64.9°	67.5°	64.3°	58.0°	52.4°

Average date of last frost in Spring, from 1836 1885, May 16th.
Average date of first frost in Fall, from 1836–1885, September 20th.

C. A. GOESSMANN, *Director*.

ASSISTANTS IN 1884.

Joseph B. Lindsey, Class '83, . . . Stock-feeding and Chemical Analysis.*
Charles H. Preston, Class '83, . . General and Analytical Chemistry.*
H. J. Wheeler, Class '83, . . . General and Analytical Chemistry.
Winthrop E. Stone, Class '82, . . Biology and Field Experiments.

* Messrs. Preston and Lindsey have since accepted more lucrative positions elsewhere.

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